DOCUMENT RESUME

ED 304 809 EC 212 299

AUTHOR	Moore, Gary T.; And Others
TITLE	Designing Environments for Handicapped Children: A Design Guide and Case Study. First Edition.
INSTITUTION	Educational Facilities Labs., Inc., New York, N.Y.
PUB DATE	79
NOTE	94p.
AVAILABLE FROM	Academy for Educational Development, 1255 23rd St., N.W., Washington, DC ($4.00 plus postage).
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Architecture; *Design Requirements; *Disabilities; *Educational Facilities Design; Elementary Secondary Education; Human Factors Engineering; Outdoor Activities; Physical Activities; *Physical Environment; Playground Activities; *Playgrounds; Preschool Education; Structural Elements (Construction)

ABSTRACT

This guide addresses the planning and architectural design of play/learning environments for special needs children. The exceptional children discussed include those with most types of mild to severe handicaps and developmental disabilities. Specifically excluded from consideration are health impairments, severe psycho-emotional difficulties such as autism and psychosis, severe or profound mental retardation, and orthopedic handicaps if they are not accompanied by other learning disabilities. Section 1 defines and discusses the range of developmental disabilities covered, reviews literature on exceptional education and the physical environment, and briefly describes the procedure used in creating and using a generic behaviorally-based architectural design guide. Section 2 discusses the role of the physical environment in the development of children with exceptional problems and presents 14 design principles with specific user requirements for designing play/learning environments. Examples of the design principles include: continuity and branching, clear accomplishment points, retreat and breakaway points, barrier-free environments, and challenging environments. A case study in Section 3 shows how to apply the design principles to a particular situation, client, and site, and is illustrated by a design for an outdoor play/learning environment for the St. Francis Children's Center in Milwaukee, Wisconsin. (JDD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

0206

ED304809

DESIGNING ENVIRONMENTS FOR HANDICAPPED CHILDREN

A Design Guide and Case Study

Gary T. Moore, Uriel Cohen, Jeffrey Oertel, and Lani van Ryzin

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Marjorie Webster

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

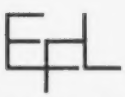
EC 212299

BEST COPY AVAILABLE

A report from EPL

DESIGNING ENVIRONMENTS FOR HANDICAPPED CHILDREN
A Design Guide and Case Study

Gary T. Moore, Uriel Cohen, Jeffrey Oertel, and Lani van Ryzin
University of Wisconsin-Milwaukee



Educational Facilities Laboratories
New York
1979

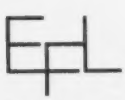
Copyright © 1979 by Gary T. Moore and Uriel Cohen

First Edition

Library of Congress Catalog Number: 79-89670

Produced by the Publishing Center for Cultural Resources, N.Y.C.

Cover photograph by Frederick A. Jules; Washington Environmental Yard, Berkeley, California



Educational Facilities Laboratories
A Division of Academy for Educational Development
680 Fifth Avenue
New York, N.Y. 10019

Table of Contents

Preface 5

Acknowledgements 6

Introduction 7

SECTION 1
Developmental Disabilities and the Environment

The Realm of Handicapped Children 9

- The Nature of Exceptional Children 10
- Differences Among Children and Variations Within a Child 10
- Types of Exceptionality: Physical, Intellectual, and Social-Emotional 11
- The Disadvantages of Classifying Children 13
- Incidence of Developmental Disabilities 13
- Educational Facilities for Handicapped Children 14

Handicapped Children and the Physical Environment 14

- Design Concepts 17

Designs for Exceptional Education 21

Applied Research and Design: The RPDE Process 26

- Procedure 28

How to Use the Guide 32

SECTION 2
Design Guide: Developmental Goals and Design Principles

User Profiles 37

Anthropometrics 41

Developmental Goals 41
- Motor Development 46
- Cognitive-Perceptual Development 47
- Social-Personality-Emotional Development 50

Design Principles 52
- Continuity and Branching 54
- Range of Social Scale 55
- Imageability and Orientation 57
- Paced Alternatives 58
- Repetition and Multiple Coding 60
- Loose Parts 61
- Ambiguous to Defined Settings 63
- Orderliness and Consistency 64
- Variety of 3-Dimensional Spaces 65
- Clear Accomplishment Points 67
- Retreat and Breakaway Points 68
- Emotional Release Areas 70
- Challenging Environments Without Undue Risks 71
- Barrier-Free Environment 72

SECTION 3
Case Study: The St. Francis Children's Center Outdoor Play-Learning Environment

The Context: The St. Francis Children's Center 75

Preliminary Design 78

Suggestions for the Application of Design Principles 80

Final Design Proposal: The St. Francis Children's Center Play/Learning Environment 80

- Organizing Concepts in the Site Design 81
- Interconnected Series of Built Structures 83
- Hedge Maze and Garden Area 86
- The Hills 86
- Open Playing Field 87
- The Woods 88
- Design Summary 88

Design as a Response to Behaviorally-Based Principles 88

- Application of Design Principles 88

Summary and Conclusions 92

References 93

Index 95

Preface

The School of Architecture and Urban Planning at the University of Wisconsin-Milwaukee has been dedicated to the teaching of behavioral, social, and cultural approaches to design since the school opened in 1968. Since 1975, when a graduate option in Environment-Behavior Studies was first offered, a series of environment-behavior courses and graduate architecture design studios have been offered that focus on both research and the integration of behavioral-social-cultural factors in the design process.

In the spring of 1976, Gary Moore initiated a seminar on environments for the developing child, and a national conference on play/learning environments the next fall. Later that year the school was asked by the St. Francis Children's Activity and Achievement Center in Milwaukee if it would be able to give architectural programming and design assistance for a special outdoor play/learning environment for the mentally handicapped children at the center. In response to this request an advanced design studio was arranged under the joint direction of Professors Gary Moore and Uriel Cohen. Lani van Ryzin and Jeff Oertel joined the team as graduate team leaders for research and design respectively.

The conceptual approach to the project was based on an integrative approach to research and design developed by Moore and Cohen which stresses applied research, programming, design, and evaluation. The staff and administration at the St. Francis Center were involved as integral members of a participatory community-oriented design process throughout the project.

The project was completed in five months and a report prepared by Team 699 was used by the St. Francis Center to aid its fund-raising drive. The report also received a Citation for Applied Research in the Progressive Architecture 25th Annual Awards Competition. With support from EFL, the current authors were able to add to, rewrite, and illustrate the report in its present form.

EFL's interest in facilities for young children and children with learning or physical disabilities extends back to the 1960s when the organization was a grant-making foundation. EFL grants enabled designers and administrators to develop and refine preschools, and EFL publications such as The Early Learning Center and Patterns for Designing Children's Centers became well-known sources of information for planners, parents, architects, and the people who run children's centers. Recently EFL has operated an information service to make arts facilities and programs more accessible to the handicapped population.

Acknowledgements

We would like to express our deep appreciation to the many people who helped this project and book in various ways. The administration and staff at the St. Francis Center were stimulating and rewarding to work with as we stumbled to understand the ways in which special children use and are affected by their physical environment and to translate this into design ideas. Special thanks to Geri Giannotta and Renee Knutilla, Coordinators, and to Sr. Joanne-Marie Kliebhan, Director, and Eli Tash, Administrator.

Our thanks to the other members of Team 699 who contributed to earlier research and design -- Deborah Buck, Bruce Lunde, Scott Nolinske, Martha Perschbacher, and William Starmer. All are now graduates of the School. Also to Gunilla Torell from Sweden who was a Visiting Post-Graduate Fellow in Environment-Behavior Studies. To Myles Graff who coordinated this programming phase of the project we owe a special thanks; only his graduate studies at the University of Minnesota have prevented him from being a co-author of this book. Thanks to Wendy Golden and Jeff Beer who helped prepare new user profiles. And a very warm thanks to Frederick Jules and especially to Tim McGinty for permission to use their photographs and many sketches of children at play. Finally, to Liz Kidera and Kris Kimble who prepared all of the charts and diagrams, to Ann Hill who contributed new information for the design guide, to Mary Keeler and the staff of UWM Photographic Services who prepared the photographs, and to Roger Hart, Robert Lewis, Robin Moore, Leland Shaw, and Bill Vance for permission to reprint some of their photographs of children and their environments.

Leland Shaw of the University of Florida, who together with Nan Plessas has designed many environments for handicapped children, helped us prepare the groundwork for this project. His own design ideas for outdoor play/learning environments for handicapped children have been a source of inspiration throughout, and his criticisms on our work leading up to this book have been greatly appreciated.

Our sincere thanks also to Dean A. J. Catanese of the School of Architecture and Urban Planning and to Professor Robert M. Beckley, Chairman of the Department of Architecture at the University of Wisconsin-Milwaukee and to our other colleagues here for providing the intellectual and professional climate and support services which make this type of work a pleasure.

Introduction

> "All children can learn if we can learn how to teach them." -- Motto on the cornerstone of the St. Francis Children's Activity and Achievement Center, Milwaukee.

Designing Environments for Handicapped Children is intended as a general guide for the planning and architectural design of play/learning environments for children with exceptional problems which hinder normal patterns of development and learning. It is intended for educators, child psychologists, designers, and administrators.

The book is organized into three sections. Section 1 defines and discusses the range of developmental disabilities covered, reviews current literature on exceptional education and the physical environment -- including significant architectural examples -- and briefly describes the procedure used in creating and using a generic behaviorally-based architectural design guide. Section 2 -- the kernel of the design guide -- discusses the role of the physical environment in the development of children with exceptional problems and presents 14 design principles with specific user requirements for designing new environments. A case study in Section 3 shows how to apply the design principles to a particular situation, client, and site. This section is illustrated by a recently completed design for an Outdoor Play/Learning Environment for the St. Francis Children's Center in Milwaukee.

The "exceptional children" discussed in the book include most types of mild to severe handicaps and developmental disabilities which affect children from birth through adolescence. These disabilities include mild and moderate mental retardation, the whole range of specific learning disabilities (visual, auditory, and speech), and orthopedic handicaps that involve other developmental or learning disabilities and affect school performance.

Specifically excluded from consideration are orthopedic handicaps if they are not accompanied by other learning disabilities, health impairments, severe psycho-emotional difficulties such as autism and psychosis, and severe or profound mental retardation. The foregoing are excluded because they have been dealt with elsewhere (as in the case of barrier-free architecture for strictly orthopedic handicaps) or because the disability is so severe (as in the case of profound mental retardation) that little is known of the direct or therapeutic effects of relatively subtle architectural interventions. Also excluded are the particular needs of children extremely gifted in one or another developmental domain. Each of these other topics requires its own information base for design decisions.

A word of caution: There are many ways to make the environment a better place for developmentally-disabled children; many ways, for example, in which a child with a severe sight problem might be able to receive stimulation through other sensory means; many ways in which the environment might have a more direct therapeutic value and be more accommodating to the work that teachers, therapists, and parents would like to do with children. We have only scratched the surface of what could be a lifetime exploration. Our hope is that this book may open a few eyes to the role of the physical environment in helping children to overcome developmental problems and difficulties, and may lead to more work in this area.

Two lines of work in particular need to be pursued: (1) more ideas for making environmental design interact with exceptional education and making the environment a stimulus with therapeutic value; and (2) more empirical research in testing these ideas to see if they actually work and have demonstrable and lasting effects.

The authors hope that this book may raise new questions and encourage others to follow where we have not yet trod and to correct mistakes which we have not seen.

Section 1
Developmental Disabilities and the Environment

The Realm of Handicapped Children

There are about 75 million children in the United States under 19 years of age. The U.S. Office of Education, Bureau of Education for the Handicapped, estimated in 1970 that 7 million children (one out of ten) has at least one handicap that affects one or more areas of development and school performance. More recent Office of Education figures based on improved national data collection techniques indicate that "at any point-in-time, the percentage of children in the general school population with current handicapping conditions requiring special educational programs would be between 7.5% and 8.5% of such population" (Melcher, 1977; cited in Blessing, 1978, p. 3).

American education is based on the ideal of equality before the law and equality of opportunity. All children must receive help in learning to the limits of their capacity, whether that capacity be large or small. Federal legislation now mandates that wherever possible children with mental or physical handicaps must be mainstreamed into regular classrooms. Where this is not possible, and for limited time periods for diagnostic or intervention services, children with special needs are helped by special institutions.

Special diagnostic and treatment centers have been established for children with severe learning, hearing, sight, and motor problems -- centers for autistic children, hospitals for crippled children, facilities for blind or deaf children, group homes for retarded children, and, of course, state and county institutions for the severely mentally retarded. In many cases there is a shortage of places for children, insufficient qualified personnel, and not enough specially designed curricula and extracurricular programs.

In special educational facilities and mainstreamed classrooms, little attention has been given to the quality of the built environment, beyond providing for health, safety, and the most basic of functional considerations. This is due, in part, to the lack of enabling legislation, and in part, because educators, child psychologists, and architects have failed to appreciate the intimate relationship between educational programs and architectural settings.

But the situation is changing. The 1970 Education of the Handicapped Act (P.L. 91-230) and the 1975 Education for All Handicapped Children Act (P.L. 94-142) are enabling schools to obtain funding for renovation and special environmental design in order to make educational facilities more responsive to the special needs of exceptional children. Concurrently, the architectu-

ral and education professions, and their research arms in particular, are becoming aware of the effect of the physical environment on exceptional children and are beginning to make this role more widely known. Another positive development is the current realization that free play and semistructured play are integral to children's development and therefore have therapeutic value for children with developmental difficulties.

There are two reasons for this lack of action: (1) a gap between educators and architects concerning children's interactions with environments that may be developmentally critical; and (2) a lack of clear presentation of research results that can be applicable to design.

The Nature of Exceptional Children

The interchangeable terms "exceptional children" and "handicapped children" encompass a wide range of deviations from average rates of development in children. The first term refers to both handicapped and gifted children, but this book -- and recent national data -- focuses on children with developmental disabilities.

Thus exceptional children includes children with developmental lags that interfere with normal patterns of development and learning. These difficulties include mild and severe retardation, visual or auditory perceptual difficulties, mild or severe speech disorders, behavioral or emotional disturbances, particular learning disabilities (like reading problems), and orthopedic handicaps. Common to all these conditions are developmental difficulties and lags that require a modification of early childhood or school services in order to insure maximum potential development and school learning.

Differences Among Children and Variations Within a Child

A significant characteristic of many exceptional children is that although they may be below average in one ability, they can be average or above average in all other mental and physical abilities. Kirk (1972) refers to this as the concept of variations within the same child, or intra-individual variations. Most tests of mental ability are constructed by determining childrens abilities relative to other children, and then setting norms which are communicated to

DISABILITY TYPE	CHARACTERISTICS
1. Physical Disabilities	• Orthopedic Handicaps: Slight to severe limitation of physical mobility. Learning abilities not directly altered. • Neurological Impairments: Range from mild lack of coordination to complete helplessness. Sometimes effect perceptual-intellectual abilities such as speech and vision. Proper support can minimize effects on learning abilities. • Mild Motor-related Disabilities: Hyperkinetic behavior, poor motor-perceptual coordination. Limited effects on learning abilities and performance.
2. Perceptual-Intellectual Disabilities	• Mental Retardation: Generally, IQ below 70; impaired adaptive behavior. Functioning ranges from complete independence for mildly or educably retarded to complete dependence on others for profoundly retarded. • Speech and Communication Impairments: Problems in oral expression, articulation, and comprehension. Little or no effect on general intelligence. • Visual Limitations: Varying visual acuity to complete blindness. Effect mobility, interpersonal relations, and general performance. Generally does not cause developmental lags. • Hearing Limitations: Varying auditory perception to complete deafness. Effect language and speech, interpersonal relations. No effects on intellectual abilities. • Specific Learning Disabilities: Normal performance in most repects, but specific disability effects learning. Typical symptoms: hyperactivity, short attention span, difficulty acquiring, processing and expressing information.
3. Social-Emotional Disabilities	• Difficulties in interpersonal relations, withdrawal, aggressive behavior, difficulty dealing with abstracts and ideas. Direct effects on intellectual development, learning, and school performance.

Types of exceptionality and their characteristics.

An environment equally accessible and equally exciting to the average child and the exceptional child. Air-filled foam and polyeurethane dummies at Children's Village, Toronto, by Eric Macmillan, Designer. (All photographs by the authors unless noted.)

A special education class for children with perceptual and cognitive developmental difficulties. A small manipulables corner at the St. Francis Children's Activity and Achievement Center, Milwaukee, by Brust-Zimmerman Architects.

parents and others in finely-calibrated, age-related growth charts. This has unfortunately obscured an important fact -- that exceptional children may be essentially "normal" with just one or perhaps two specific and well-defined disabilities -- and has led to the dangerous situation where many exceptional children are thought to be subnormal or retarded. The exceptional child is indeed different from other children. He or she may not see or hear as well, may not have mobility of the average child, etc., but is very average in all other regards.

More important for all involved with exceptional children -- parents, educators, and designers -- is to keep in mind that an exceptional child is a normal child who has exceptionalities or deviations from the average only in some characteristics. Thus a child may be relatively capable in certain tasks but weak in others. In sum, an exceptional child is a normal child who has exceptionalities or deviations only in some characteristics. For the vast majority of exceptional children, the similarities with average children far exceed the differences (Kirk, 1972).

Types of Exceptionality: Physical, Intellectual, and Social-Emotional

There are two classifications of exceptionality: medical classifications focusing on suspected causes and reflecting a medical model of treatment, and developmental-educational classifications focusing on the description of observable behavioral deviations from average patterns of development and learning. Because educators and architects are confronted with observable realities and are not primarily interested in etiology, this guide will use a developmental-educational frame of reference.

Although there are many possible ways to categorize exceptionalities, we will follow a standard developmental categorization and refer to those affecting the three major areas of human development: motor or physical development; perceptual-cognitive or intellectual development; and social-emotional development. The following descriptions of disabilities are based in part on discussions in Dunn (1965), Kirk (1972), and Cruickshank (1977), to which the reader is referred for more detail.

Physical Disabilities

Disabilities in the physical or motor area include:

- orthopedic handicaps
- neurological impairments
- mild motor-related disabilities

Orthopedic Handicaps. Severe orthopedic handicaps may include the loss of use of one or more limbs as well as less-severe handicaps including motor hyperactivity and poor sensory-motor coordination. Fine-motor as well as gross-motor movements may be affected to the extent that the child is referred to as "clumsy" or "uncoordinated." Most physical disabilities do not affect educational achievements in school, though consequent emotional, social, and interpersonal problems may. Schools adapt by providing barrier-free physical environments, special physical facilities for wheelchairs, and other physical aids. There are excellent design guides on barrier-free architecture (e.g., Goldsmith, 1976), which adequately cover this area. Only motor handicaps involving other developmental or learning problems will be treated here.

Neurological Impairments. Motor handicaps, however, can result from neurological impairments and may be accompanied by mild or severe mental

Working one-on-one with an exceptional child.

Getting children to work together and to feel what it's like to touch, and to trust.

retardation, speech defects, and visual defects. Examples of such neurological impairments are cerebral palsy and spina bifida.

Mild Motor-Related Disabilities. Hyperkinetic children and those with poor motor or perceptual-motor skills may have learning problems in reading, listening, and writing.

Perceptual-Intellectual Disabilities
This is the largest area of developmental disabilities. There are five main types of perceptual and intellectual disabilities:

- general mental retardation
- speech and communication impairments
- visual limitations
- hearing limitations
- specific learning disabilities

Mental Retardation. Children with general IQs below 70 or 80 are usually referred to as mentally retarded, which means a general intellectual disability across wide bands of intellectual and other functioning, while those with IQs in the range of 80 to 90 are classified as slow learners. The mentally retarded child is unable to profit sufficiently from regular school programs, but has potential in three areas which, depending on severity of retardation and availability of people, programs, and supporting environments, can be nurtured: educability in academic subjects; social adjustment; and occupational skills.

In terms of potential development, some mentally retarded children are able to learn academic subjects at a minimum level, to get along independently in the community, and to learn skills so as to be partially or totally self-sufficient economically, while totally dependent or profoundly mentally retarded children are unable to be trained in self-care, socialization, or economic usefulness and need complete care and supervision throughout life.

Speech and Communication Impairments. There are many forms and degrees of speech and communication defects ranging from asphasia, a little-understood organic cause of language retardation, to minor articulatory disorders and stuttering. The defect may occur by itself, or as in the case of cerebral palsy and mental retardation, it may be associated with other more severe developmental disabilities. Speech defects can have repercussions on language development, interpersonal relations, and social maturity, but unless autism is present, they do not normally affect other areas of general intelligence or learning such as reading or other perceptual-cognitive developments.

Visual Limitations. Visual limitations include complete blindness, visual defects that can be corrected through treatment or optical aids, and some visual limitations that despite optical aids, still require instructional and physical environmental compensations. With these compensations, children can move more easily through space and can use other senses to supplement their residual vision. Whereas complete blindness may affect mobility, interpersonal relations, and educational achievements, the effects

of other visual impairments are not as great, but still require a range of environmental adaptations.

Hearing Limitations. Auditorially handicapped children may be deaf or only hard of hearing. They may have had the disability from birth, or may have developed deafness or hearing difficulties after learning language and speech. Deafness is often irremediable, and will affect the development of language and speech, though generally not intelligence. The hard-of-hearing child will not be affected in these areas of development, though subtle auditory sensations which tell him or her so much about the world (like sound of leaves in the autumn) may be lost if environmental adaptations are not made.

Specific Learning Disabilities. The term learning disabilities refers to children who do not have obvious physiological disabilities yet cannot learn certain things in ordinary home and school situations. This is a relatively new classification, sometimes previously referred to as "brain-injured" or "minimal brain dysfunction" to hide the fact that no one understood the reasons for certain developmental disabilities. Such children are not hard-of-hearing, but may have difficulty with understanding language; do not have impairments of the eyes, but cannot read easily; are not mentally retarded, but cannot learn under ordinary school instruction.

Specific learning disabilities are primarily of the perceptual-intellectual type and inhibit the child's normal development in reading, writing, calculating, spelling, remembering, and related abilities. (See Dunn, 1965; Kirk, 1972; Wallace & McLoughlin, 1975; and Cruickshank, 1977, for additional information on learning disabilities.)

Social-Emotional Disabilities
The third major type of developmental disabilities experienced by children is in the area of social and emotional development, including personality and interpersonal behavior. Often labelled "behavior disorders," "emotional disturbances," "social maladjustments," or even "delinquency," they take a variety of forms ranging from withdrawal and restraint to hostility and agression.

Social-emotional difficulties may seriously affect other areas of intellectual development, learning, and school performance. The difficulties usually show up either in poor development or low school grades, for which the cause is ascribed to emotional difficulties, or in marked social or emotional immaturity relative to other areas of developmental maturity, e.g., breaking down or being uncontrollably aggressive or withdrawn at seemingly minor perturbances.

Social-emotional difficulties also include a poor self-concept, distorted body image, difficulties in interpersonal relations, and in one of its most severe and perplexing forms, autism, the complete inability to communicate verbally or non-verbally.

The Disadvantages of Classifying Children

In the above conceptual framework two properties stand out:

- Developmental disabilities may be thought of as difficulties in one or more physical, perceptual-intellectual or social-emotional developments.
- It is more important to consider how a child differs within him or herself than it is to lump together all children with the same disability as if they were the same in all other ways.

Classification and placement according to IQ or separation of all children who have reading difficulties into one class ignores the more critical intra-individual variations. Children with a developmental disability still need the whole range of social situations and peer interactions. The danger of pigeon-holing people is that we may only see a few similarities and miss the characteristics that make them unique individuals. To generate creative behaviorally-sensitive design ideas, it is less valuable to know general global characterists than to know that some children have problems with figure-ground reversal, others with color discrimination, and still others with visual acuity, and so on.

Certain ethical factors need also to be considered in using classification systems in exceptional education. Most tests have been standardized on white, middle-class groups and are not appropriate for other cultural groups (Kirk, 1972, p. 168). Similarly, "normal" and "abnormal" are typically defined in terms of the dominant cultural group and do not take into account differences in ethnic, racial, or socio-economic groupings. In using terms such as "behavioral disorders" or "social disturbance," we must realize that these categories are defined in relation to a single cultural system and norm and do not represent absolute conditions.

Incidence of Developmental Disabilities

Various estimates have set the incidence of exceptional children at 7.5% to 12.5% of all children between birth and nineteen years of age (Kirk, 1972). Excluding the roughly 2% who are extremely gifted in one or more abilities, there may still be as many as 1 in every 10 children who have some form of mental or physical handicap. But, as suggested in the Intro-

Disability Type	1968 BEH Estimates[a]	1978 BEH Reports[b]	1978 Wisconsin Point-in-Time Report[c]
Speech Impaired	3.5%	3.5%	2.69%
Mentally Retarded	2.3%	2.3%	1.85%
Learning Disabled	1.0%	2.0%	1.68%
Emotionally Disturbed	2.0%	2.0%	.83%
Hearing Limited	.6%	.11%	.18%
Visually Limited	.1%	.04%	.07%
Physically Handicapped	.5%	.5%	.29%
	10.0%	10.47%	7.59%

Sources:
[a] US Office of Education, Bureau of Education for the Handicapped, 1969; from Kirk, 1972.
[b] US Office of Education, Bureau of Education for the Handicapped, 1978; from Blessing, 1978.
[c] Wisconsin Department of Public Instruction, Division for Handicapped Children; from Blessing, 1978.

Incidence of developmental disabilities among children. Table 1

duction, this is the cumulative incidence for a fiscal year. Estimates are that 7.5% to 8.5% of all children require exceptional education services at any one time (Melcher, 1977). Precise breakdowns of this figure into categories are known for some states, and can be compared with the cumulative totals, as shown in Table 1.

It will be noted from Table 1 that the most prevalent type of developmental disability is speech and communication impairments; the next most common is mental retardation. Many children formerly listed under emotional disturbances are now seen to have some form of specific learning disability. Percentages in this category have been rising and can be expected to continue to increase relative to the other types.

Educational Facilities for Handicapped Children

There are five main ways in which children with exceptional education needs receive assistance. This design guide applies to environmental adaptations in all five.

- Visiting Professionals: Speech therapists, reading disability specialists, and other professionals visit children in the classroom and help teachers establish special materials, and curricula -- and special environments.
- Special Classes and Resource Rooms: Increasingly, special classes are organized within a school, and resource rooms are established for part-time specialized instruction.
- Special Schools: In many cases, special day schools have been established, especially for mentally retarded, severely learning disabled, and multiple handicapped children. The St. Francis Center, the subject of the case study in Section 3, is a special school of this type connected with a county-wide referral service.
- Residential Schools and Institutions: All states have residential schools or institutions of various types. They are the oldest form of education for exceptional children, and usually are away from population centers, thus becoming segregated and sheltered asylums.
- Hospitals and Homebound Services: When handicapped children are confined to their homes or hospitals, some school systems assign itinerant teachers to them. A few hospitals have also begun to make special provisions.

Handicapped Children and the Physical Environment

The past decade has seen considerable growth in the environment-behavior field. Research on child-environment interactions, in particular, has contributed to new and existing theories. Yet, despite this growth, little is known about the role of the physical environment in exceptional education.

Our literature search uncovered 240 books and articles on some aspect of exceptional children, education, or development from which inferences could be drawn for design, but very few of these directly addressed the interrelationships between exceptional children and the physical environment. This lack of information, coupled with our own experience of having to inductively arrive at design implications from a variety of seemingly unrelated sources of information, further confirmed the need for a generic design guide which would be more comprehensive, up-to-date, and more applicable to design than the literature previously available.

There are five types of literature relevant to design programming for exceptional education:
- development and education of exceptional children
- empirical environment-behavior research on exceptional children
- information on the environment and physical disabilities
- design source books and guides
- descriptions of facilities

Development and Education of Handicapped Children

First, there is a large body of literature on child development and on educational and therapeutic interventions for exceptional children, of which Dunn (1965), Kirk (1972) and Cruickshank (1977) are well-known source books. Though designers can extrapolate design-relevant information from these sources -- expecially by using the three-column format sheets developed for this project — most of them fail to mention anything about the role of the physical environment. Three exceptions to this pattern are the now somewhat dated, though interesting works of Strauss and Lehtinen (1947), Cruickshank (1967, revised 1977), and Johnson and Myklebust (1967).* Based in part on the developmental theories of the comparative developmentalist, Heinz Werner, Strauss and Lehtinen argued that the constant stimulation found in regular classrooms would promote undirected, diffuse, and disinhibited behavior in what were then called "brain injured" children, i.e., children with certain learning disabilities. Furthermore, they believed that by manipulation and controlling the physical environment, the child would develop voluntary control of impulses. Specific design recommendations included making the classroom large enough so that large distances would separate children, eliminating unessential visual materials, and even covering the windows or temporarily isolating a child by screening him or her from potentially disruptive stimuli.

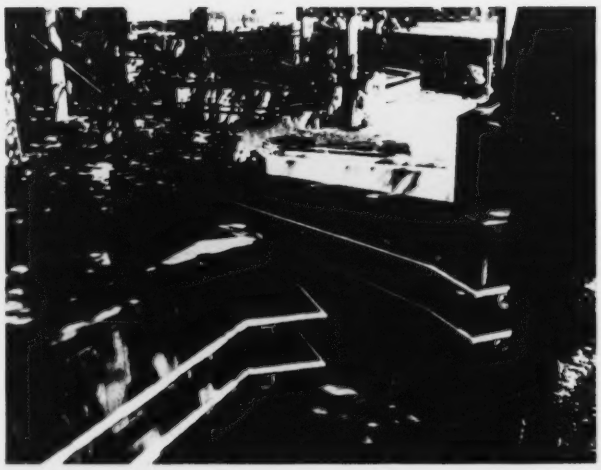
Similar to Strauss and Lehtinen's ideas, both Cruickshank (1977) and Johnson and Myklebust (1967) argued that spaces for learning-disabled children, and hyperactive children in particular, should be free of excessive visual and auditory stimulation. Johnson and Myklebust suggested the provision of small quiet spaces where an emotionally distraught child could restore emotional control. This suggestion has been used to justify "isolation rooms," which are now seen as somewhat barbarous.

Of this group of early theorists, Cruickshank's recommendations for environmental design were the most systematic and the most widely followed.

Four principles were advanced:

- the reduction of unnecessary background environmental stimulation
- the increase of the figure stimulation of instructional materials
- the reduction of the gross amount of space around each child
- the establishment of highly structured situations and spaces

* Our awareness of the work of Strauss and Lehtinen is due to an excellent review in a doctoral dissertaion in progress on environmental psychology by Jeff Weiland at the City University of New York.



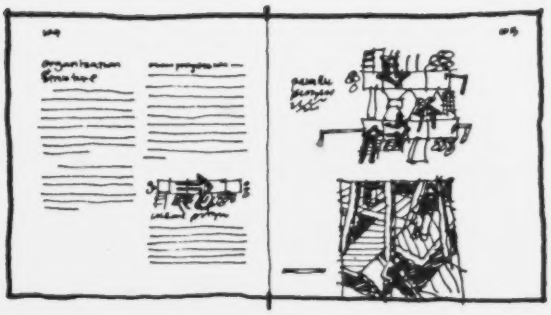
The establishment of highly structured settings to reduce unnecessary confusions for retarded children. The Jesse Stanton Developmental Playground, New York, by Richard Dattner, Architect.

Though arising from the same theoretical notion as Strauss and Lehtinen about reducing unnecessary stimulation, Cruickshank recommended making the space small and unifying all materials (floors, walls, and windows covered in the same way) so that instructional stimulation (figure) would stand out clearly from environmental (ground) stimulation.

Research on Exceptional Children and the Physical Environment

A second area of knowledge about exceptional children and the physical environment should arise from empirical research specifically looking at the links between the physical environment and the behavior or development of exceptional children. We were surprised at the paucity of literature in this area.

Cruickshank's theories and environmental design recommendations have been evaluated by himself (Cruickshank, 1961) and independently (Bentzen, 1962). Whereas Cruickshank found that the reduction of unnecessary stimulation led to a significant overall improvement, Bentzen found that very few children were able to be transferred into regular school programs 3 years later. Other studies -- of a more controlled nature -- have indicated that the level of hyperactivity in learning-disabled children decreases when visual stimulation is increased, but that there are no significant gains in children's abilities in quiet special settings like Cruickshank's cubicles. The somewhat contradictory nature of these findings, combined with the predominant finding of no difference due to the physical interventions tried, should, on the one hand, make us extremely wary of taking any sort of environmental determinist position, and, on the other hand, should make us aware of the necessity for



Typical layout from a design guide. (Drawing by Tim McGinty.)

more creative design interventions and for more exacting scientific research to see if there is indeed any "therapeutic" impact of the physical environment in helping children to overcome developmental disabilities.

The Environment and Physical Disabilities

A third body of literature deals with the environment and physical disabilities. This includes excellent and comprehensive books by Goldsmith (1977), Nellist (1970), and Mace and Laslett's (1974) illustrated handbook for the North Carolina Building Code. Ries (1973) and Jorgensen (1975) have produced valuable books on design standards for barrier-free environments in outdoor recreation settings. The latest in this series is Steinfeld's (1977) revision of the American National Standards Institute's document ANSI A117.1. This standard pertains to barrier-free environments and handicapped access, and will be adopted by most local and state building codes, as was its predecessor (ANSI A117.1, 1966). The standards include directives relative to the design of stairs, walkways, doors, toilets, drinking fountains, telephone booths, elevators, and other building components.

These sources are extremely valuable for making indoor and outdoor environments accessible for physically handicapped people. Most, however, do not deal with the needs of the learning disabled, retarded, and other mentally handicapped. They do not focus specifically on children, nor do they go in great depth beyond standards for removing barriers, i.e., they do not treat the stimulus or therapeutic values of properly designed physical environments.

Design Guides and Source Books

The literature source seemingly closest to our needs, and providing practical design ideas for special children, includes design source books by Bednar and Haviland (1969), Texas A&M University (1969), Abeson and Blacklow (1971), Bayes and Francklin (1971), and Osmon (1971). Osmon's book, Patterns for Designing Children's Centers, is an excellent design guide, but does not treat the needs of exceptional children. Ironically, despite the subtitle of the Texas A&M University book, Environmental Criteria: MR Preschool Day Care Facilities, almost no design information relates specifically to mentally retarded children. The other books make practical design suggestions for the environments of exceptional children, including some suggestions for play environments. Many of these sources, however, are now out of date in that they do not respond to the wealth of recent environment-behavior theories, concepts, and research information on child-environment relations. Despite the increasing awareness in the education and exceptional education fields that the physical environment may have a significant impact on exceptional children, i.e., that the physical environment may enhance or inhibit the daily operation of an educational program, environment-behavior studies and related aspects of the social and behavioral sciences are underrepresented in this literature. As Abeson and Blacklow noted in 1971, the environment-behavior field was at that time "in a stage of development. The emerging sophistication in this field must lead to increased attention to the learning space as an experimental variable and its effects on the learning process" (p. viii). The field, which still can be described as a developing discipline, has much more to offer now, and has heavily influenced the present work.

Descriptions of Facilities

The last category is the design literature that shows illustrations of indoor and outdoor facilities. Some of the best-known designs are by Richard Dattner in New York and Leland Shaw in Florida. Shaw's 1970 Orlando project is one of the best. Unfortunately, the behavioral rationale behind the design decisions is seldom mentioned in the architectural press. It may not even be considered by most designers of environments for exceptional children. Moreover, completed projects are almost never evaluated after they are in use.

However, design projects and buildings can serve as a useful basis for design images and ideas which can be put together in a different way in a new project, and can serve as a way of predicting the impact of alternative physical settings on behavior. If published design projects included accompanying statements of program objectives and behavioral rationale for design decisions, and were subsequently evaluated in use, they would be much more valuable as a source of ideas for future designs. The process of integrating behavioral information and evaluation is described in the next chapter. At present, there is a danger of becoming enamoured with flashy solutions or solutions by well-known designers. These ideas may be incorporated in subsequent designs without knowing if they work-

ed or not in previous use, without knowing if they led to creative play or were boring to children, and without knowing if they led to any developmental gains or were ineffective. For these reasons, the approach used in this project, and the integrative research-and-design approach advocated in general, incorporates post-occupancy evaluation and feedback into future programming as well as into additional basic research.

Despite these objections to many designs, some significant examples of design for exceptional children are published here to serve as a source of images for future designs and for future research.

Design Concepts

A review of design source books and papers for exceptional children has led to the following lists of designers' concepts. Some authors' concepts are based on empirical reports, and others are based on their experience as designers of facilities. Some authors have been very explicit about their concepts while for others we have had to read between the lines and infer the design concepts from bits and pieces of information. In these cases the concept labels are our own; we hope we haven't done the authors an injustice. An attempt has been made to express each author's main ideas in physical environmental terms, much like our own subsequent design principles in Section 2. Finally, there are overlaps among authors.

Kenneth Bayes: The Therapeutic Effect of Environment on Emotionally Disturbed and Mentally Subnormal Children

Kenneth Bayes, an English architect and environmental psychologist put forth the position in 1967 that the environment can have a direct stimulus and therapeutic effect on emotionally disturbed and mentally subnormal children. The environment not only satisfies physical needs but also the less-easily defined needs of the psyche, which have been largely neglected. In short, he believes that "space acts as a therapeutic agent" (p. 4).

Concepts:

1. Sociopetal Planning -- centrally focused spaces to encourage the development of stable human relationships (based on Osmond, 1957)

2. Avoidance of Corridors -- making sociofugal circulation spaces into sociopetal activity spaces, so as to minimize the possibilities for disorientation and spacetime confusion

3. Transition -- between the zones of private, intimate, and public space to aid maladjusted children in making behavioral transitions

4. Avoidance of Ambiguity -- to assist in orientation and easy identification

5. Architectural Character and Scale -- including cultural familiarity with the environment, to assist with identification

6. Variety of Group Size -- create spaces for 1 child, 4 to 9 children, and a maximum group size not to exceed 30 children, to

Sociopetal planning—centrally focused spaces to encourage the development of interaction and communication among children. Pacific Oaks College Children's School, Pasadena.

An adventure playground. Huntington Beach Adventure Playground, Huntington Beach, California, originated by Bill Vance, Recreation Supervisor.

allow for privacy, emotional security, and socialization and to minimize anti-social behavior

7. Flexibility -- not to be confused with ambiguity, to aid in adapting programs to changes in children's needs, and to allow children to rearrange and subdivide spaces, but not to upset the child by unnecessary or quick changes

8. Pattern and Visual Stimuli -- repetition of the same patterns and motifs to help in re-establishing rhythm and harmony in the child without creating flickering or other unpleasant effects

9. Stimulating to Cool Colors -- it is suggested that excitable children respond best to stimulating colors, and withdrawn ones are helped by cool colors (Birren, 1961)

10. Staff Needs -- if the staff is content, the children may be better looked after

11. Child Participation -- in decisions about color, furniture, and other finishing details, though not overall architectural form, as children need to feel involved; however, "the preferences of the child may not have any relation to what is psychologically good for him" (p. 24).

Lady Allen of Hurtwood: Planning for Play -- Play for Handicapped, Subnormal, and Maladjusted Children

In her exceptional 1968 book on play, Lady Allen, a life-long advocate for children's rights and needs, argued that it is important to insure that handicapped children can have rich, varied, and spontaneous experiences wherever they may be. Enjoyment as well as development through free play are important for children with mental, emotional, or physical handicaps. She advocates the creation of adventure playgrounds for handicapped as well as regular children.

Lady Allen did not state her objectives as specific design recommendations, but as behavioral objectives:

1. Adventure Playgrounds for Handicapped Children -- including materials and loose parts and dens that can be constructed and destroyed by the children to stimulate the imagination and provide for free challenge and discovery

2. Variety of Sensory Materials -- natural materials, loose parts, level changes, etc., to allow for sensory experience

3. Opportunities for a variety of perceptual-motor experiences

4. Opportunities for exploration

5. Opportunities for free creative play

6. Opportunities to challenge the whole body

7. Opportunities for self-initiated activities, challenges and dangers, and opportunities for mastery

Since her ground-breaking work, the Handicapped Adventure Playground Association (1975) has been formed in Britain.

Michael Bednar and David Haviland: The Role of the Physical Environment in the Education of Children with Learning Disabilities

Two research architects, Bednar and Haviland, developed a comprehensive series of what they called "environmental conceptualizations" in 1969. Their basic position was that the physical environment can play roles in special education programs by providing comfort, by being specially planned and designed to fit specific approaches to special education, or by playing a direct stimulus and therapeutic role. Space, light, color, sound, texture, and shape are expected to be the critical architectural variables

Environmental conceptualizations:

1. Space-Time Identity -- making activities which are adjacent in time also adjacent in space

2. Avoiding Ambiguity -- children must develop a sense of security and confidence in their relation to the environment and visual tricks or ambiguous space may confuse them

3. Articulation -- parts clearly differentiated and articulated from each other, including the indoors from the outdoors, to help children recognize and prepare for changes in activity and behavior and to overcome perseveration by providing a definite stop to one activity before starting another one.

4. Transition Spaces -- between major changes in activities (after Bayes, 1967)

5. Decisions and Alternatives -- avoiding no alternatives and too many alternatives or un-demarcated alternatives, to minimize possibilities of confusion

6. Consistency -- in details, in procedures, while not overlooking articulation, transi-

tion, and alternatives, in order to provide the child with a consistent environment to help compensate for his or her own lack of consistency in behavior

7. Child Scale -- in order to provide a sense of security and belonging, achieved through child-scaled objects like blackboards and a child-scaled appearance of the building as a whole, without overdoing scale accommodation and making the staff look like giants

8. Sociopetal Arrangements -- drawing people together and assisting them in interacting with each other, to facilitate interaction and socialization (after Osmond, 1959; Bayes, 1971)

9. Privacy -- visual, acoustic, physical, and psychological privacy, essential to good mental health and to the development of personal identity

10. Territoriality -- provision of a place to call one's own and the accompanying ability to establish and defend the place, critical for the development of individuality and self-concept

11. Usability -- avoiding architectural barriers and difficulties in operating hardware and elements like doors, windows, cabinets, lockers, etc., i.e., accessibility or barrier-free design

12. Ordered Movement Systems -- including cues to circulation, a simple circulation pattern, and the transformation of sociofugal circulation spaces into sociopetal activity spaces in their own rights (after Bayes, 1967)

13. Character -- "it won't be a school, it won't be a home, it won't be an institution, and it won't be a clinic; it will be what it is" (p. 7/16) , i.e., what is often called "functional honesty."

Ronnie Gordon: The Design of a Preschool Therapeutic Playground

Ronnie Gordon is an early childhood educator with years of experience with multiply-disabled children. Her basic position, put forth in 1969 and 1972, is that development occurs through an individual's interaction with the environment. Young developmentally-disabled children not only need but are entitled to exposure to all of the learning experiences and peer relationships that are afforded the child with developmental integrity. Opportunities for the child to experience the natural out of doors is a critical part of this.

Child scaled space. Nooks and crannies built by children at the Huntington Beach Adventure Playground.

Concepts:

1. Natural Environments -- open space and natural materials, to provide foundations for all development through rich and varied experiences with aspects of the world often denied to the handicapped child

2. Clear Delineation of Activity Areas -- to facilitate the ordering and organizing of stimuli

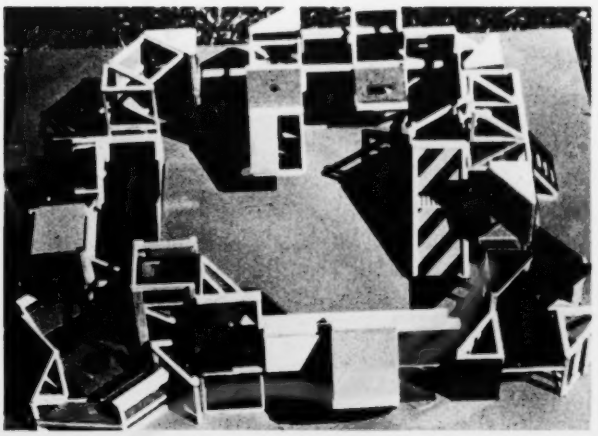
3. Different Degrees of Difficulty -- assortment of approaches and exits, thus making environments and experiences accessible to a wide range of children

4. Quiet Nooks -- for individual play and small-group interaction.

Leland Shaw: Unified Play Spaces and Exterior Sensory Learning Environments

The final set of design concepts to be considered are those of Leland Shaw, a designer of outdoor play/learning environments for children with various types of developmental disabilities. Recently his ideas have been collected into a set of what he calls "primary design criteria," (Shaw, in press). His basic position -- a child-environment feedback loop -- is that the child is an information-seeking organism who learns about self and the world via sensory interaction with the environment (Shaw and Page, n.d.).

Natural environments are a necessary part of all children's lives. Washington Environmental Yard, Berkeley, California, by Robin Moore, Landscape Architect, and Herb Wong, Environmental Educator. (Photograph courtesy of Frederick A. Jules.)



A study model of the Unified Play Space, by Leland Shaw, Designer. (Photograph courtesy of Leland Shaw.)

Primary design criteria:

1. Sense of Place -- the transmission of an overall prevailing atmosphere, in order to create a stage set for the process of play through time

2. Unified Play Space -- sequentially-organized play space where all parts are interconnected physically and spatially, to sustain the child's attention over time, to increase the amount of time spent playing, to help develop spatial cognition ability, and to allow for changes in use, mood, and pace

3. Variety of Spaces -- a variety of enclosures that vary in size and feeling of enclosure, from small to large, from well-defined to areas that lack spatial definition, to support a wide variety of children-generated activities

4. Key Activity Places and Paths -- the provision of key activity areas at natural seams and multiple paths between activities, to provide the potential for a variety of activities to occur without clashes

5. 3-Dimensional Juxtaposition of Parts -- a matrix of spaces, platforms, and pathways including group gathering places about the ground, juxtaposed to maximize physical, verbal, and visual interaction, to allow children with handicaps to find paths that relate to their abilities, and to present other challenges to be met as they develop

6. Nonobjective Space -- ad hoc collections without literal symbolism or concrete resemblance to something specific, to stimulate creativity and imagination

7. Variety of Materials -- surface, textural, and haptic variety, colors, and bold simple graphics, to stimulate perceptual development

8. Loose Parts -- manipulable elements, especially sand and water, and balls, blocks, toys, dolls, etc. provided by the staff, to insure stimulation.

Comparison

As can be readily appreciated, there is considerable overlap in the ideas of the above author/designers, while there are also differences of opinion about factors to be stressed in the environment of exceptional children. Kenneth Bayes stresses the need for environmental stimulation and a concern for avoiding undue ambiguity. Bednar and Haviland, following Cruickshank, place heaviest stress on the avoidance of excessive visual and auditory stimulation and of potential confusions in the organization of the environment. Lady Allen's focus is on the need for loose parts and a variety of materials in the life-space of the handicapped child, while Ronnie Gordon emphasizes the importance of the natural, out-of-doors for the developmentally-disabled child. Finally, Leland Shaw points out the importance of unity of design, scale, varieties of spaces, and sensory stimulation. Taken together, these writers provide a rich array of design ideas for anyone concerned with the physical environment of exceptional children.

Many of these design ideas have their roots in empirical research reports, although none of this group has conducted basic research on exceptional children and the environment and a few ideas seem to be transplants from traditional philosophies

of modern architecture (e.g., "functional honesty") and may or may not be found to be effective. As these design ideas are derived inductively from existing research or experience, they have the same status as hypotheses, and are thus subject to test and corroboration or refutation as to whether or not they lead to the hypothesized developmental affects. In at least one case, some of Leland Shaw's work, an attempt is being made to evaluate completed environments in terms of the hypothesized concepts. The clear articulation of concepts and their hypothesized affects, then, can help as the first step of empirical validation through post-occupancy evaluation or basic empirical research.

In order to get a better handle on this variety of concepts, we have organized, compared, and summarized them in chart form. Two charts are shown, Tables 2 and 3. Table 2 presents a comparison of the various concepts, while Table 3 shows that taken together they may be seen to fall into 8 categories of design concepts.

Table 3 sets the stage for our own work in Section 2. The design guide in Section 2 is composed of a number of developmental objectives followed by inductively-derived design principles. Some of our recommended design principles overlap with those presented in Table 3, but our emphasis is on new principles which add to the existing literature and on those for which we believe there is the greatest amount of empirical support.

Designs for Exceptional Education

One of the project subteams made an extensive search of the architectural literature -- both books and magazines -- for exemplary designs for play/learn environments for exceptional children. In addition we had at our disposal several films on the subject, and we enlisted the advice of experts in the fields of exceptional education and recreation.

The intention of our search was to identify exemplary models, and where possible to extract both positive and negative lessons from these cases.

The number of playgrounds specially designed for the needs of exceptional children was found to be extremely limited, and until the recent New York City Design Competition for "A Playground for all Children" (US Department of Housing and Urban Development, 1978), the number of designers with any experience in this area was few. Many designers have adapted their ideas to the needs of physically handicapped children, making all parts of play areas accessible to the handicapped, but few have yet to consider the special needs of the mentally handicapped, the retarded, and the more mildly learning disabled.

It was found, however, that the specially designed play areas that do exist are very differ-

Bayes (1967)	Lady Allen (1968)	Bednar & Haviland (1969)	Gordon (1972)	Shaw (in press)
sociopetal planning	adventure playgrounds	space-time identity	natural environment	sense of place
avoidance of corridors	variety of sensory materials	avoiding ambiguity	clear delineation of areas	unified play space
transition	variety of perceptual-motor experiences	articulation	different degrees of difficulty	variety of spaces
avoidance of ambiguity		transition	quiet nooks	key activity places and paths
scale and character		decisions and alternatives		3-dimensional juxtaposition
variety of group sizes		consistency		non-objective space
flexibility		child scale		variety of materials
pattern and visual stimuli		sociopetal		loose parts
stimulating to cool colors		privacy		
staff areas		territoriality		
child participation		usability		
		ordered movement systems		
		character		

Design concepts for exceptional children: summary and comparison of explicit and implicit concepts by other designers. Table 2

BEST COPY AVAILABLE

ORGANIZATION OF SPACE

- Unified play space (Shaw)
- 3-dimensional juxtaposition (Shaw)
- Key activity places and paths (Shaw)
- Decisions and alternatives (Bednar & Haviland)
- Different degrees of difficulty (Gordon)
- Sociopetal arrangements (Bayes; Bednar & Haviland)

SCALE AND CHARACTER

- Sense of place (Shaw)
- Child scale (Bayes; Bednar & Haviland)
- Familiar cultural character (Bednar & Haviland)

CLARITY AND CONSISTENCY VS. AMBIGUITY

- Consistency (Bednar & Haviland)
- Space-time correspondence (Bednar & Haviland)
- Clear delineation of areas (Gordon)
- Transitions (Bayes; Bednar & Haviland)
- Articulation (Bednar & Haviland)
- Avoidance of ambiguity (Bayes; Bednar & Haviland)
- Ordered movement systems (Bednar & Haviland)
- Avoidance of corridors (Bayes)
- Avoidance of unnecessary stimulation (Cruickshank; Strauss & Lethinen; Johnson & Myklebust)
- Functional honesty (Bednar & Haviland)
- Non-objective space (Shaw)

GROUP AND SPACE SIZES

- Variety of group sizes (Bayes)
- Variety of spaces (Shaw)
- Quiet nooks (Gordon)

SENSORY MATERIALS

- Natural environment (Gordon)
- Variety of materials (Allen; Shaw)
- Pattern and visual stimulation (Bayes)
- Stimulating to cool colors (Bayes)

LOOSE PARTS AND ADVENTURE PLAYGROUND

- Adventure playground (Allen)
- Loose parts (Shaw)

OTHER

- Territoriality (Bednar & Haviland)
- Flexibility (Bayes)
- Accessibility (Bednar & Haviland)
- Staff areas (Bayes)

PARTICIPATION

- Child participation (Bayes)

Table 3 showing groups of related design concepts.

A design project explicitly for exceptional children. The monorail and sand pits at the Jesse Stanton Developmental Playground.

ent from traditional or contemporary playgrounds. Specially designed play areas are usually conceived of in therapeutic terms, and are designed to allow and encourage close contacts between children and professional staff. The ratio of staff to children is usually very high, a condition not found on traditional American neighborhood playgrounds. The team also looked at published examples of other indoor or outdoor environments for early childhood development, but as these do not deal specifically with exceptional children, they are not illustrated here (see Cohen, Moore, and McGinty, 1978 for examples of outdoor play environments for average children).

Four examples follow.

Jesse Stanton Developmental Playgound, Institute for Rehabilitative Medicine, New York University Medical Center, New York. Richard Dattner and Associates, Architects

The Jesse Stanton Developmental Playground by Richard Dattner is one of the most frequently published play/learn environments for exceptional children (see "Learning can be fun," 1970; Gordon, 1972; Cohen, Moore, & McGinty, 1978).

Influenced by the developmental and design ideas of its founder and director, Ronnie Gordon, the philosophy of the Jesse Stanton Developmental Playground was "to bend the environment to meet the needs and provide growth potential for the severely disabled child" (Gordon, 1972, p. 5). The playground was designed to stimulate children, to get them involved with it, and to prevent the failure-frustration syndrome so common in the attitude of exceptional children. The concepts stressed by Gordon and by Dattner in-

clude a spectrum of clearly delineated activities and areas so that children can learn to coexist and yet can keep safely out of each other's way.

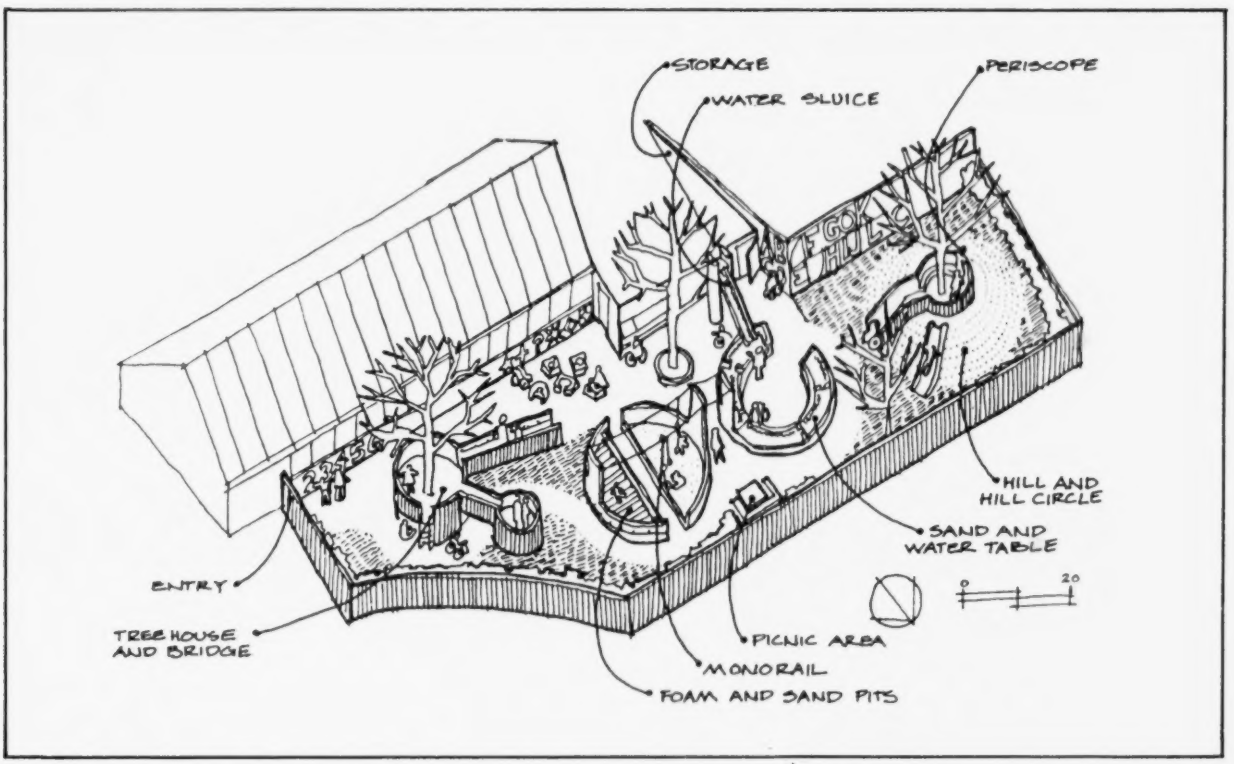
The design is organized around four octogonal modules: a climbing treehouse with a bridge and three different means of access -- ramps, stairs, and ladders; a symmetrical pair of sand and foam-mattress crawling-walking play area; a water and sand play area; and a grass climbing mound. Mobiles over the foam-mattress area had considerable potential for perceptual, fine-motor, and perceptual-motor development, but have been removed due to technical difficulties. All areas can be reached by a meandering path for wheelchairs, as most of the children have severe physical handicaps. The water and sand play area was constructed for use by children in wheelchairs, and has an interesting waterfall where the water enters the stepped water-table from an overhead, translucent sluice-way.

It cost $70,000 ($12.50/sq. ft.) in 1969, and covers an area of 5600 sq. ft. Materials are exposed concrete, natural wood, asphalt, grass, trees, and shrubs.

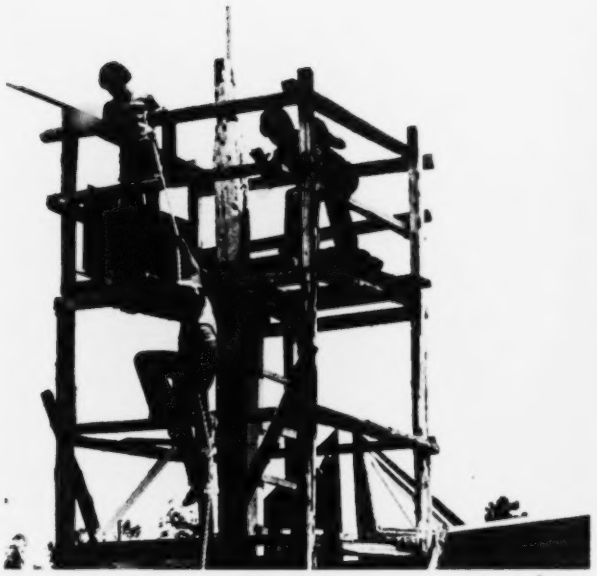
The choice of materials responds to the need for a variety of sensory experiences, durability for extended outdoor use, and considers special needs like hard surfaces for wheel-chair mobility. The facility is used by severly handicapped preschool children. The staff to child ratio is almost one-to-one. While the facility would also be attractive to non-handicapped children, and is more interesting than most conventional playgrounds, it lacks the dramatic challenges found in other contemporary playgrounds and lacks the loose parts thought to be so necessary for perceptual and cognitive development. As a model it might be appropriate for a "quiet play" area zoned into a larger playground, and made us wonder about the possibility of more challenging, creative, and imaginative built play areas, and about the use of more extensive natural settings for exceptional children.

Adventure Playgrounds for the Handicapped, Several Examples in London, England. Organized by the Handicapped Adventure Playground Association

"The value of adventure playgrounds is now widely recognized; the same principles are being adapted to the handicapped. The adventure playground should be specially designed to give enjoyment, as well as sensory-motor training to children with mental, emotional, or physical handicaps including those of vision, hearing, and perception" (Lady Allen, 1968, Chapter 8).



An overview of the Jesse Stanton Developmental Playground. (Drawing by Frederick Jules, after Richard Dattner.)



Adventure playgrounds are appropriate for the physically and mentally handicapped, as well as for average children. Harbourfront Adventure Playground, Toronto.

A pre-designed, pre-built playground for handicapped children. Children's Health Center of the Mid-Peninsula, Palo Alto, California, by Jay Beckwith, Designer.

Adventure playgrounds for average children are built in a spontaneous and ad hoc way by the children themselves, and are not designed, except for proper siting and site development work. Adventure playgrounds for exceptional children are partially designed and partially left up to the whims and imagination of the children themselves. Children build a variety of structures and use them in novel and imaginative ways. These semi-directed, semi-self-initiated activities provide a variety of experiences and developmental potentials not available in more protected environments. Opportunities range from those which call upon fine-motor and gross-motor skills to those calling upon the manipulation of building materials, opportunities for decision making, spatial judgments, geometric and arithmetic measurements, and problem-solving, and opportunities for social development, cooperation, and communication (Handicapped Adventure Playground Association, n.d.). As for success, Lady Allen's follow-ups over many years (e.g., at the Chelsea Handicapped Adventure Playground which she began) indicate, for just one example, that emotionally disturbed children can be brought out of their shells by the coordinated use of adventure playgrounds and special educational experiences.

Handicapped Children's Playground, Children's Health Center of the Mid-Peninsula, Palo Alto, California. Jay Beckwith, Designer; Big Toys Inc., Manufacturer

The Children's Health Center Handicapped Children's Playground is an example of a playground designed around play equipment available from a manufacturer. Several companies are now manufacturing equipment for exceptional children.

This playground is sited adjacent to a preschool for handicapped children. Materials are Western red cedar logs, 5-1/2 to 8 in. in diameter, 1 in. galvanized steel pipe, 16 gauge steel slides, 1/2 in. nylon climbing ropes, and recycled tires, along with tables, chairs, and large toys like tricycles brought outdoors from the school. The site is 4,200 sq. ft. with a combination sand and natural ground cover base. Separating the school from the play area is 12 ft. of asphalt. The cost for the equipment was $7,000 in 1973. Labor and site preparation were donated by staff and parents under the designer's direction.

Most playgrounds developed from manufacturers' catalogues are composed of modular, fixed-in-place pieces assembled on the site. The only dynamic element is the tire swing, and the only loose parts are the sand and ground cover.

These are nice, safe, vandal-proof structures which for the most part support physical activities, primarily of the gross-motor, large-muscle, and balancing kinds. The designer, Jay Beckwith, views them as "stage sets for play -- armatures which need to be supplemented by smaller, flexible, and loose elements" (Cohen, Moore, & McGinty, 1978, p. 49). They are best in school settings where other loose parts and play things can be moved outside and used in combination with or proximity to other types of play experiences.

Often they are selected and assembled by parents and staff, which is a major advantage.

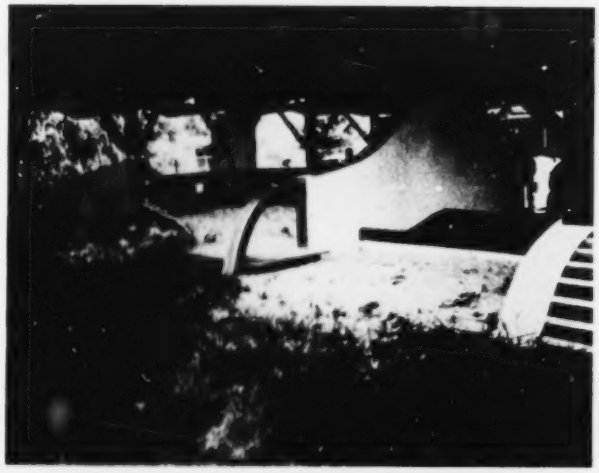
Magruder Environmental Therapy Complex (ETC) and Miami Cerebral Palsy Association Exterior Sensory Learning Environment (ESLE) Orlando, Florida, and Miami, Florida. Leland Shaw, Designer; Nan Plessas, Architect

Leland Shaw and Nan Plessas have devoted most of their practice to the design of environments for children, including exceptional children in various communities in Florida (see "Playing to Learn," 1970; Shaw & Robertson, n.d.; Witengier, n.d.; United Cerebral Palsy Association of Miami, n.d.). These two play/learn environments were designed respectively for physically-perceptually handicapped children and for children with cerebral palsy. They are somewhat typical of many environments for exceptional children, in that they are tied with a school or institutional setting and are restricted in use to children with one or another special handicap. They are atypical, however, in their creative design, understandings of exceptional children, and opportunities for child development.

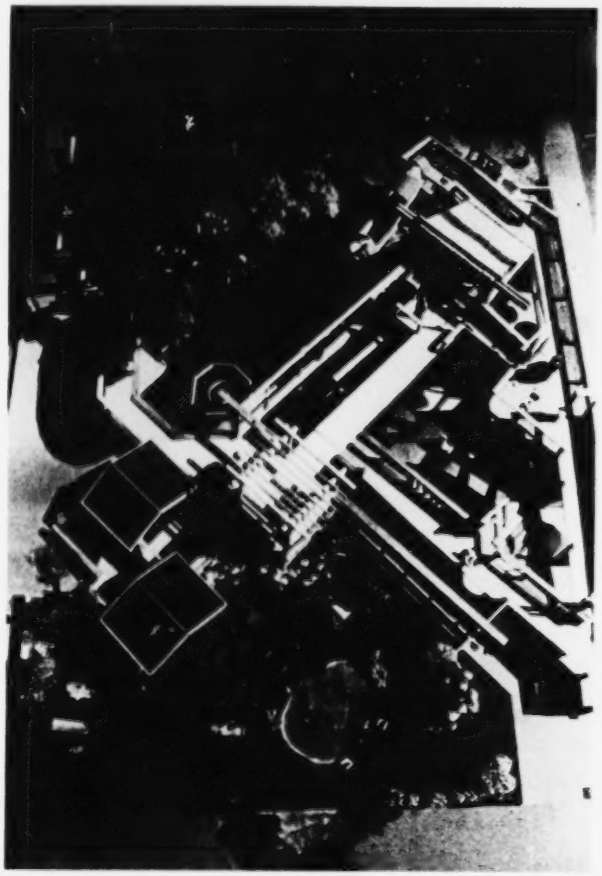
The purposes of these playspaces were to stimulate and heighten the perceptual and motor functions of children, and to provide a fun, safe environment where children could, whenever possible, leave their braces and wheelchairs behind. In part the success of these environments -- at least the Magruder ETC which has been completed for some time -- is witnessed by the glee on the faces of the children as they scramble over its forms and rush to get free of their protheses to join in the fun.

The Magruder ETC complex is built in three wings adjoining a regular school. The children are brought specially to the environment by bus from centers in the Orlando area. One wing contains the entry, unbracing and bracing area, storage, and other functional facilities. A second wing contains a number of horizontal and linear mazes built from low, carpeted walls with gentle and not-so-gentle rises between them. The third wing contains more vertical mazes built of a series of shallow and steep steps interlaced with mirrors and oblique and vertical climbing surfaces. A central, free-play area has hanging forms, punching bags, and stuffed mobiles. Primary colors and supergraphics are used throughout. The bracing-unbracing and functional areas are enclosed. The other wings are partially covered with a wood-truss space frame so that the play area can be used in very hot or wet weather, and yet parts of it on the eastern side are open to a sloping terrain which leads to the large play field.

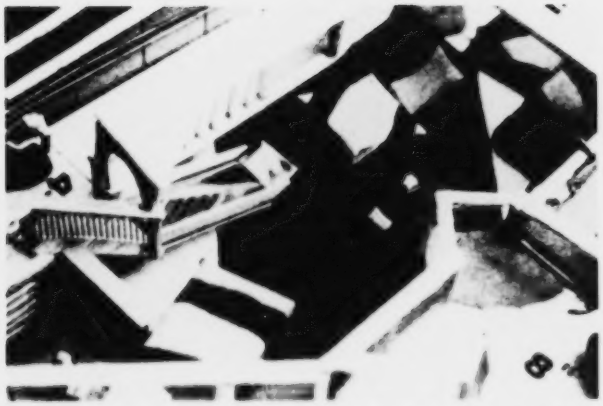
Like the Magruder ETC, the Miami ESLE complex is



The Magruder Environmental Therapy Complex, Orlando, Florida, by Leland Shaw, Designer. The use of a space frame to create indoor-outdoor space for self-initiated activities.



Aerial view of a model for the United Cerebral Palsy Exterior Sensory Learning Environment, Miami, by Leland Shaw and Nan Plessas, Architect. The roof has been removed to show the organization of the space. (Photograph courtesy of Leland Shaw.)



A detail of the Exterior Sensory Learning Environment—a padded jumping area and a gentle slide for severely physically and mentally handicapped children.

partially enclosed and partially open, but this time for children most of whom are unable to move without the aid of their wheelchairs (severe cerebral palsy). The Miami ESLE environment has a long winding, slightly sloping pathway which allows the children to move from ground level to tree branch height. They can overlook ponds and a bird cage, and generally move around and through a specially designed semi-natural environment. For children who are partially or more-fully ambulatory, there are a series of mazes and climbing steps reminiscent of the Magruder complex. A large tree and tree house dominate the site. There is also a central, group platform area and a large nature area. Around these key activity areas are a series of interconnected subsidiary spaces: a cave, a sand play area, a bouncing pad, bird cage and aquarium, a pond, and various step progressions, slides, and ramps. There is a sequential link between the various areas of the ESLE complex, unified by a series of ramps which enable those in wheelchairs and those with braces to move throughout the complex. The large, soft falling and bouncing pad is constructed in units that can be moved and textures changed. There are not a lot of moveable or loose parts in the complex, the designers preferring to encourage staff to bring toys, dolls. etc., out from the adjacent indoor facility. Considerable provision is made for adults -- teachers and therapists -- to play and work with the children in the ESLE environment.

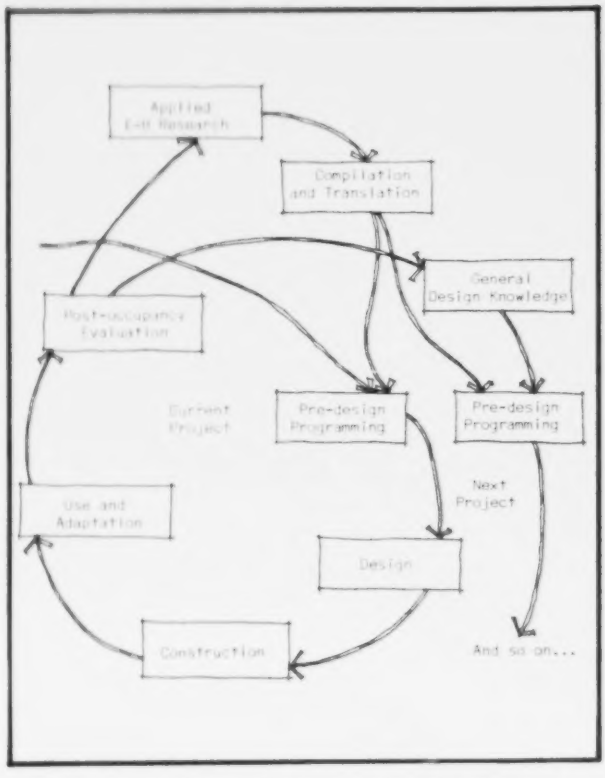
Applied Research and Design: The RPDE Process

To conduct this project, a process was developed that would incorporate the many pronged tasks of gathering design-relevant information, involving user groups, translating the information into a general design program, and developing prototypical design solutions. The approach used in the project was based in part on the behaviorally-oriented pattern language of Christopher Alexander and his colleagues (Alexander, Ishikawa, and Silverstein, 1977) and the participatory design processes of Henry Sanoff and his colleagues (Sanoff, 1977), and on our previous work on the integration of behavioral research with design (Moore, 1975; McGinty, Moore, & Cohen, 1977; Cohen & Moore, 1977; Cohen, 1978).

In conducting integrated research and design, the ordering of activities does not fall into a simple sequence, but involves an overlapping of tasks as work evolves. A behaviorally-based research and design process includes the following five stages in rough chronological order:

- Applied Research/Information Gathering: including use of a range of standard environment-behavior and programming methods -- behavior setting observations, group focused interviews, review of relevant environment-behavior, developmental, educational, and design literatures, use of consultants, and -- when a case study is involved -- site analysis

- Programming/Developing a Design Guide: organization of the information gathered,



The RPDE Process: Research/Programming/Design/Evaluation.

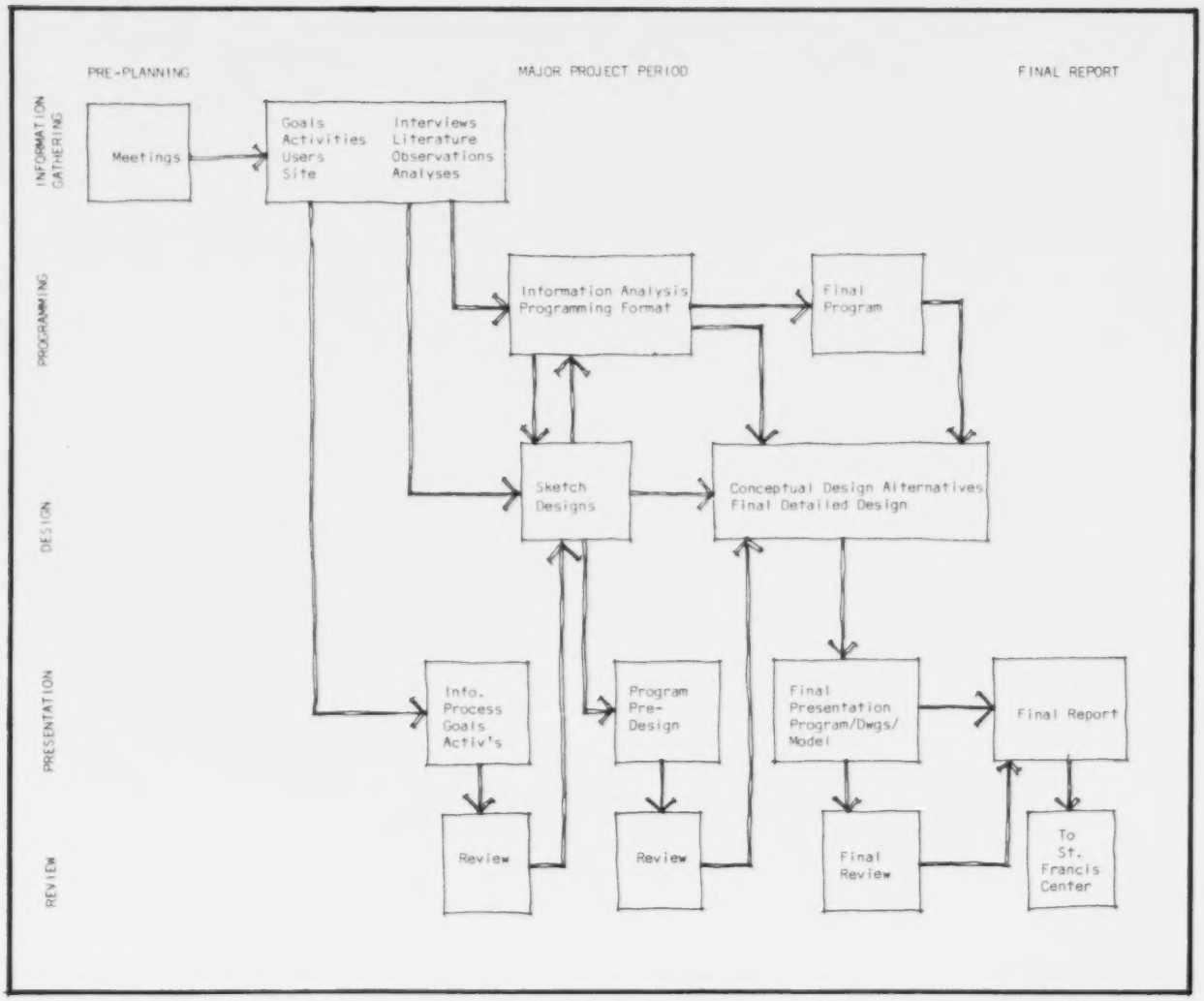
including gaming and participatory sessions to establish developmental goals, activities, and supportive behavior settings, with the end product being a series of behaviorally-based design principles and related user requirements

- Design: developing schematic and detailed design proposals which incorporate and indeed grow organically from the design principles, including participatory design with representative user groups

- Presentation and Review: presentation at critical junctures -- after information gathering, development of the program, preliminary and detailed design proposals, and final documentation for review by the client and representatives of each user group involved, and feedback and modification as necessary of earlier steps

- Post-Occupancy Evaluation: development of a post-occupancy evaluation instrument and procedure for evaluation of the completed project in use, and feedback into more basic research to answer important questions and to improve subsequent programming and design.

Each of these stages involves a number of activities that feed into other stages in a loop-back system shown in the two accompanying illustrations.



The project activity sequence chart.

Participatory design—a weekend session between the staff and administration of the St. Francis Children's Center and Team 699. Team 699 members Gunilla Torell and Lani van Ryzin in the foreground and Uriel Cohen in the center rear, with St. Francis members Barbara Sammis in the foreground and Eli Tash and Sr. Joanne-Marie Kleibhan in the background.

Procedure

The procedure of the project involved applying each of these five stages of the RPDE process in a dynamic, participatory activity. To accomplish this, three basic teams were organized: information gathering; programming; and design. Each of these teams integrated the activities noted under presentation and review. There was considerable overlap of membership in the various teams which served to provide conceptual cross-fertilization, to enrich the design process, and generally to improve the group's morale.

Information Gathering

To create a solid theoretical base for design decisions, a thorough understanding of the philosophies, developmental goals, educational procedures, and site conditions at the St. Francis Center (SFC) was needed. Similarly, to create a solid empirical base, an understanding of the needs, developmental processes, learning difficulties of exceptional children, and the possible role of the physical environment was needed.

These information-gathering tasks were divided into six segments:

- behavior setting observations of children
- focused interviews with users, staff, and clients
- review of the exceptional education and environment-behavior research literatures
- review of the environmental design, architecture, and landscape architecture literatures
- consultations with experts in the field
- site analysis of the case study site.

Contacts were made with experts, research centers, and practitioners in exceptional education, child development, and architecture in a search for key works and ideas. A computerized search of published literature was conducted. A bibliography and library of materials began to grow as pertinent books and articles were assembled, labeled, and filed in the project's library.

Reports on play environments and other potentially-relevant design literature were sifted through and reviewed. Information was gathered from persons involved in the design of play settings for average children as well as of specialized settings for handicapped children.

All members of the project team shared the task of reading and reviewing the literature. Pertinent sections with behavioral or environmental implications were noted on specially prepared information-collection format sheets.* Over 240 books, reports, and design-relevant articles were assembled.

The format sheets allowed an accurate record of each specific piece of information and its source, and of two levels of translation: the desired user requirements suggested by the information, and some possible form implications or recommendations for design. These sheets were used throughout the information-gathering stage for items extracted from the literature and for observations and interviews done in the field. Information sheets were coded by key words and many were duplicated to allow for cross-filing information that applied to more than one topic.

During the same period, an interview team elicited a definition of developmental goals for the outdoor facility from the SFC staff. Informal group sessions attended by the team and staff provided an in-depth understanding of the Center's objectives, procedures, and requirements they had experienced in their present facility. Based on procedures of focused interviews (Merton & Kendall, 1946) and programming games (Sanoff, 1977), these sessions became spontaneous two-way communications and led to a productive, participatory process.

* This procedure is discussed in detail in Cohen, 1978.

SOURCE	OBSERVER / DATE	KEY WORDS	
Bayer, K. and Franklin, S. "Designing for the Handicapped" AIA Journal, Sept 1977, p 1065	K Nicotera / 2 10 77	stimulation (boundary) control perception paced/graded challenge	1039

OBSERVATION[1]

Many brain injured and learning disabled children have lower ability to manipulate and organize a large number of sensory stimuli, which might be perceived as chaotic and confusing.

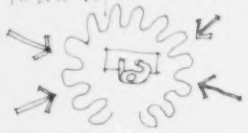
REQUIREMENTS[2]

Provide settings with variable and controlled amount of stimuli depending on

- the amount of concentration needed for the task
- the specific childs ability and capacity to manage (and react to) stimuli

FORM IMPLICATION[3]

- Buffer irrelevant stimuli when tasks require concentration

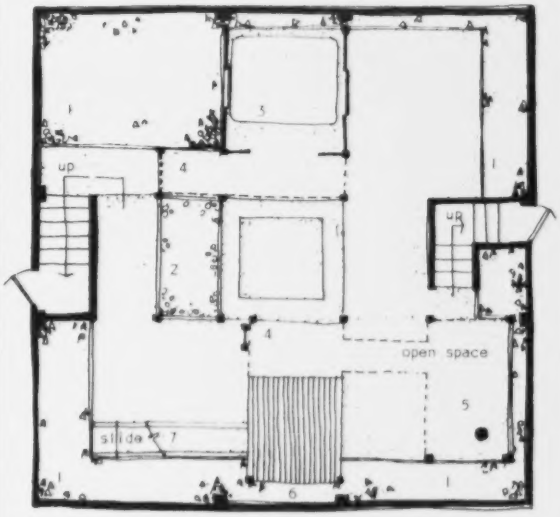


- Control and vary the number of tasks/manipulations required, or available at any given event/situation

NOTES:

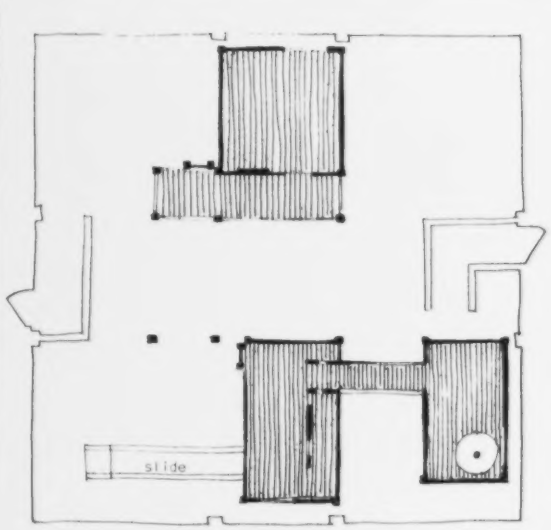
1. Consolidation of similar or congruent observations, or listing of conflicting information. Sources: literature, field observations, consultants, etc.
2. Generic design-relevant requirement; may or may not be form-prescriptive. (Typically value judgement is unavoidable in requirement development).
3. Selected example(s) for specific or general form-applications. Communication: narrative and/or graphic("ideagrams"; "solution-grams").

A format for recording design-relevant behavioral information from observations, interviews, or published literature.



S.I.L.C. CENTER, Level 1. Time:_____ Observer:_____

1. tanbark
2. stones
3. waterbed
4. ladder
5. firepole
6. wood deck
7. slide



S.I.L.C. CENTER, Level 2. Time:_____ Observer:_____

A format for recording observations of children's behavior in an indoor playground.

Parallel to these activities, an observation team set up a series of site visits to observe the ways in which the children and staff used the existing facilities. Using a variation of behavior mapping (Ittelson, Rivlin, & Proshansky, 1971), observers noted the use of equipment and space, with particular attention paid to how children interact with their environment. Lists of activities were made that might be accommodated in an outdoor facility. Three children and one staff member were followed for a day to gain a better understanding of the users' patterns of activity. The information was written up in diary-like user profile articles (this procedure is discussed in detail in Cohen & Moore, 1977). Other information gained from these observations were recorded on the standard information-gathering sheets.

Information was also collected on normal anthropometric dimensions (from sources like Dreyfuss, 1966; Texas A&M University, 1969), developmental abilities of children at different ages (from sources like Flavell, 1963; Bruner, Olver, & Greenfield, 1966; Johnson & Medinnos, 1974; and Ilg & Ames, 1955), and on handicapped access to outdoor areas (Abeson & Blacklow, 1971; Jorgensen, 1975; and Ries, 1973).

Concurrent to all of these happenings, a site analysis group set as its goals the description and analysis of the potentials and restrictions of the St. Francis Center site as an outdoor play/learning environment (see the Case Study in Section 3).

From all of these means of information gathering, over 1000 bits of behaviorally-based design relevant information was extracted and recorded on the standard format sheets. At the end of this five-week period, the monumental task of organizing the program began.

Programming

Two major tasks were involved in the programming stage: a primarily behaviorally-oriented phase, the exploration of developmental goals; and a primarily design-oriented phase, the derivation of what we have come to call design principles from the gathered information.

Since a consensus was desired on developmental goals, a series of interactive meetings and brainstorming sessions was scheduled between the project teams and the SFC staff. Over 100 developmental goals were brainstormed and recorded on individual cards. These goals ranged from broad, inclusive goals like motor development, to very specific goals like parallel and cooperative play, and ranged across the broad areas of physical, intellectual, and social-emotional development. Gaming procedures were employed to cluster similar goals. The unwieldy number was collapsed to 36 goals which were considered the most critical to the success of an outdoor play/learning facility. These were then ordered by the staff into five categories from "most crucial" to "relatively unimportant."

From this hierarchy, 14 major categories of goals emerged. These were individually posted on signs across the wall of the project studio forming one side of a matrix that would be used to organize the program. For each of the chosen major developmental goals, a set of supporting activities was developed by the staff and project team. These activites, such as balancing, climbing, and manipulating would be referred to throughout the design process.

Before the various types of information collected in Phase 1 could be used for the derivation of design principles, it had to be uniformly organized in a way that provided logical groupings in a retrieval system. All information previously recorded on the three-part information sheets was coded and grouped in two ways:

- information which elucidated similar developmental goals was grouped, e.g., all information providing user requirements or design implications for the goal of exploration and discovery
- information which led to similar design implications was grouped, e.g., all information talking about clear environmental images and orientation.

Initially the groupings were rough, and conflicting information had to be resolved. A variety of categories was tried and working labels assigned to each. Through discussions and team brainstorming, groupings were collapsed into fewer and fewer categories and labels changed to encompass the principles that were beginning to emerge from each separate file. As the groupings became clearer, the implications within each group were scrutinized to see if a design principle could be articulated that would adequately represent that particular cluster of information and implications.

Design Principles

A major characteristic of our approach to architectural programming is the development of what we call design principles. Design principles respond to and are derived from an analysis of goals and information articulating those goals. In this project, child developmental goals were articulated through the various types of information described above. The summary descriptions of developmental goals, design principles, and the arguments linking the two comprise what

we refer to as a generic, behaviorally-based design guide, i.e., Section 2, the kernel of this book.

This guide, and the design principles which are the germ of the matter, owe a considerable amount to the work of Christopher Alexander and his colleagues (e.g., Alexander, Ishikawa & Silverstein, 1977). Design principles have certain similarities to Alexandrian patterns, though they also have some intentional differences from them. In essence, to be accepted as a formal principle of design, an expressed design idea has to be a just representation of the goals and information at hand, and has to contribute to the provision of better environmental settings for the fulfillment of one or more developmental goals. This is the same as for Alexandrian patterns. But in addition, and herein lies the difference, principles are stated in an intentionally evocative way, suggestive of a whole class of solutions, rather than a definitive way, often seemingly limited to one or two concrete solutions.

We may define design principles in the following more precise way:

Design principles are evocative verbal and graphic statements of characteristics and qualities the built environment should have in order to solve certain human problems and respond to human behavior, social goals, and cultural values.*

Furthermore, to be a principle of design, in comparison with a geometric pattern of design, such statements must have the following six defining characteristics:

- similar to Alexandrian patterns, they must respond to critical environment-behavior problems in humanistic terms
- similar to traditional intuitive designer's concepts, they must generate specific design solutions and must be able to be used in explaining those solutions
- they must be based on the latest and best research information
- they must be testable
- they must be stated in environmental terms, not behavioral terms, i.e., they must specify in what ways the environment is to be designed
- they must be intentionally open-ended; they are intended to suggest form, and to stimulate the designer's imagination and intuition, while avoiding overly doctrinaire and absolute solutions that might inhibit design innovation

While evolving these guidelines, consensus was eventually reached by the team on final grouping of the information sheets and on statements of the design principles derived from each cluster of information.

A total of 14 design principles were developed and became the heart of the design program. The complete set is contained in Section 2.

Design

The process of programming and design is not linear. Schematic design had been progressing from the beginning of the project, both on the information sheets and on the drawing boards. Site plans were being roughed out as well as possible solutions to the developmental goals and activities that were being listed. As more design principles were articulated, preliminary design solutions were evaluated and modified accordingly.

Although additional discussion will be made in Section 3 about the process of using design principles, several general points should be made now. The design guide presented in Section 2 of this book is a general guide, and must be interpreted and modified to adapt to local conditions and situations. An important part of this is the site; the necessity for a sensitive and thorough site analysis can not be overestimated when designing outdoor environments for children. One wants not only to know about the character of surrounding buildings, but more important is the analysis of physical environmental factors, like soil type, drainage, patterns, existing and compatible vegetation types, existence of natural areas or the possibilities of returning a changed area back into a natural field, or marsh, or pond. Also to be considered are climatic conditions, especially wind directions, amounts and seasons of precipitation, temperature ranges, and sun angles at different times and different seasons.

In using our own design guide, two types of complexity had to be dealt with: (1) as design was proceeding concurrently with the later stages of programming, information was not all in a usable, organized format; and (2) there is complexity inherent in the program itself -- there are many goals and principles to be dealt with. The use of quick sketch problems focusing on only portions of the information at a time (to be described in Section 3) was found to be a useful tool in dealing with both of these complexities.

Participatory design sessions and discussions with the staff of the St. Francis Center were held to

* For a further discussion of design principles, the reader is referred to Cohen & Moore, 1977; and Moore & Cohen, 1978.

review alternative design solutions and discuss new ideas. The SFC staff were encouraged to suggest design ideas which they felt would fulfill the design principles and developmental goals. These were sketched cooperatively by members of the design team as well as by SFC staff members themselves. This interaction in the design process served four functions:

- to demystify design for the SFC staff
- to learn about preconceptions of the designers and clients
- to provide the project team with an enthusiastic source of criticism and new ideas while acknowledging that which is positive
- to involve the users -- in particular the staff members who would use the completed facilities -- to be involved and realize they have helped to create their own design and their own environment

The overall site layout was divided into areas of concentration and assigned to various members of the design team. Members selected specific design principles and designed environments responsive to these selected principles. The string of partial, alternative solutions served as an inventory for a "composite," a comprehensive final design. Despite the diversity of input into the design, the principles served to unify the project and enrich the array of alternative solutions. Feedback from the presentation and review sessions helped to focus design efforts into a unified design proposal.

Presentation and Review Evaluation

Presentation and review sessions served as an integral part of the information gathering, programming, and design stages. Informal, as well as formal criticism and feedback served to stimulate, modify, and enrich the program and the design process.

In the process of presenting alternative designs, a systematic method was needed to evaluate the proposals. In order to evaluate a design, to recognize if a plan or solution is acceptable, several methods may be used. The most common methods (Jones, 1970; Sanoff, 1977; see also Michelson, 1975 for more sophisticated methods) are:

- Checklists: Relevant requirements and characteristics of solutions or situations judged to be good are used as a reference checklist to confirm their existence or absence in new alternative proposed solutions.
- Rating Scales: Design solutions are examined for evidence that the stated objectives are indeed satisfied fully, partially, or not at all.
- Ranking and Weighting: Objectives and related solutions have to be ranked in order of priorities.

After evaluating the objectives, alternative designs can be evaluated to see how each one satisfies the objectives.

The final presentation of the case study to the SFC staff and other experts was evaluated on a simplified Likert-type scale. This instrument provided a systematic means of evaluation that permitted efficient tabulation of group reactions to the presentation. By identifying those aspects of the solution which were relatively strong versus those needing more work, the responses contributed to the process of finalizing the overall design proposal.

Post-Occupancy Evaluation

The process is of course not yet complete. The real test of a solution can only happen after the facility is in use for some years. Post-occupancy evaluation should take place after the project is in use and the novelty effect has worn off. Rigorous techniques and instruments which allow unbiased and systematic observation and assessment of behavior and development would aid in confirming which aspects of solutions respond to stated criteria, which activities actually take place, which developmental goals are being met effectively, and most important, which design decisions and principles actually are effective for facilitating development for exceptional children.

How to Use the Guide

This design guide can be used by different readers for different reasons and objectives. It may be useful, therefore, to understand the structure of the design guide and the ways its information can be accessed. The following sections can be used as an aid in your programming and design:

- Environment-Behavior Design Guide
- User Profiles
- Anthropometrics
- Developmental Goals
- Design Principles
- Case Study in Design Application
- Bibliography and Index.

The description of user profiles can heighten the reader's sensitivity to the daily routine and experiences of participants in the facility. To the reader who is unfamiliar with the context, this section can provide the equivalent of an exploratory visit and observation in the facility. The section about anthropometrics provides a summary of conventional data and references for specialized needs, especially in areas which require a very tight fit between user and environment. The bibliography and index provide fur-

OBJECTIVES[a]	WEIGHTS[b]	MEASURES[c]	TOTAL[d]			COMMENTS
		5 excellent 4 good 3 average 2 fair 1 poor	A	B	C	
Developmental Goals gross-motor development fine-motor development general coordination perceptual-motor coordination exploration and discovery spatial awareness imagination and creativity perceptual development representation and social role playing other cognitive developments social interaction and cooperation self-concept emotional development language, speech, hearing		☐ ☐				
Design Principles continuity and branching range of social scale imageability and orientation paced alternatives repetition and multiple coding loose parts ambiguous to defined settings orderliness and consistency variety of 3-dimensional space clear accomplishment points emotional release area challenging environments barrier-free environments		☐ ☐				
Other Requirements and Constraints storage lighting supervision etc.		☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐				
Demographic Information profession: child development design or architecture exceptional education other experience with exceptional children: education theory or research design none						
Other Comments and Suggestions						

[a] Objectives are established for an examination of goals and principles from the design guide with other local requirements and constraints supplied by the client-user group.

[b] Weightings may be established to indicate which goals, principles, and other requirements and constraints are most important.

[c] The "measure" is the actual yardstick along which a proposal or finished building is evaluated against each objective. Shown is a simple 5-point Likert-type scale. For other measures, see Sanoff (1968) and Michelson (1975).

[d] Totals can be for comparing alternative proposals or for assessing portions of a large proposal or completed building in use.

Format for interim evaluations and for post-occupancy evaluation.

ther sources on theories of child development, empirical research on exceptional children, and environmental design guides and case studies.

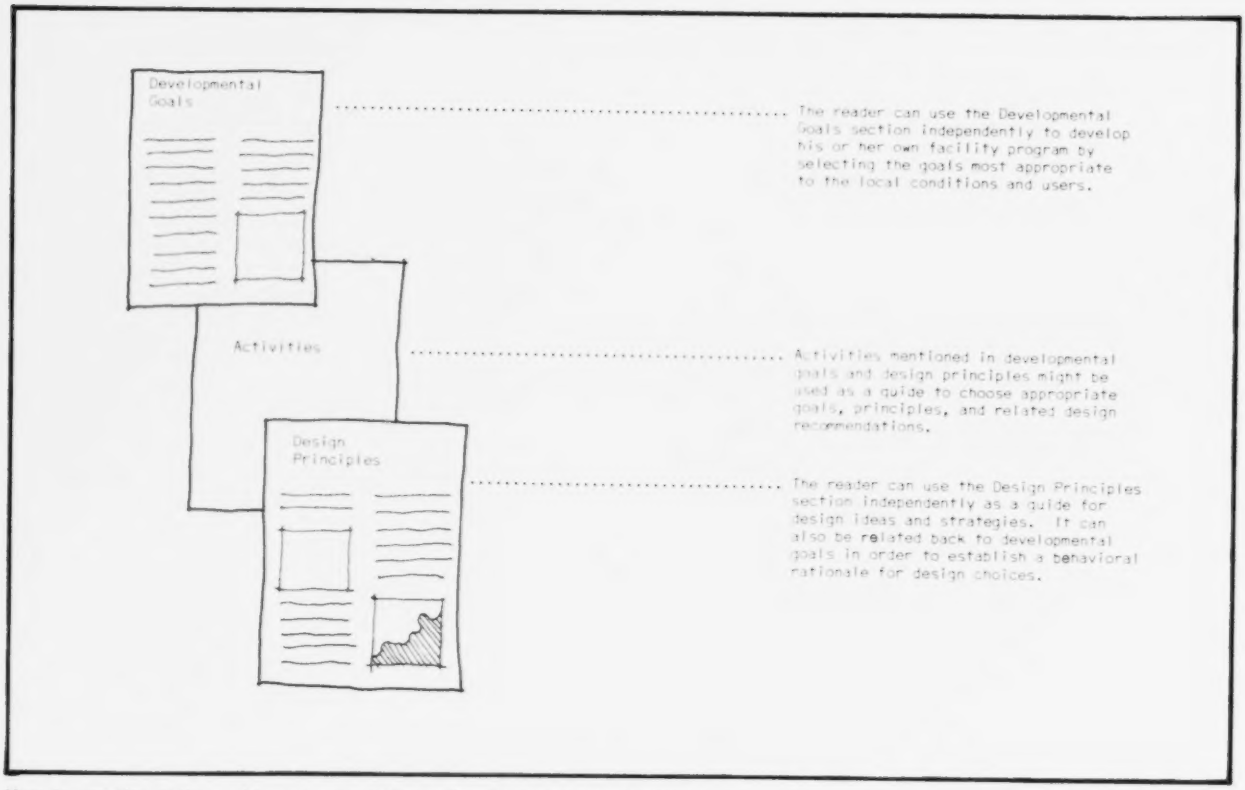
More immediate to programming are the two remaining sections which describe two basic concepts employed in the development of the design program:

- Developmental Goals: These are the important aspects of human, social, physical, and cognitive development. Some or all of the developmental goals might be adopted as the goals of the facility to be designed, as in the case of the St. Francis Children's Center Outdoor Play/Learning Environment. An example of a developmental goal is Exploration and Discovery.

- Design Principles: These are terms which describe the characteristics of the physical environment which support, accommodate, or make it possible to achieve special developmental goals. An example of a design principle is Clear Accomplishment Points.

As in many aspects of life, there are various ways to respond to each problem. Developmental goals might be achieved with more than one design principle. The possible interrelationships between specific developmental goals and design principles are mapped in the accompanying illustration.

Some readers might elect to access the program from the design principles side in search for design approaches or solutions. Other readers might concentrate on the developmental goals in the process of developing their own facility program. Others will pick selected, predetermined activities, and use this program to trace the developmental goals associated with those activities as well as to search for related design principles. Thus, depending on the reader's role -- educator, facility staff member, design programmer, or designer -- these subsections can be used simultaneously or independently for different objectives. The case study provides an example of an actual design application generated and supported by the environment-behavior program previously developed. Each part of the design solution is based upon -- and justified by -- design principles and related developmental goals. The case study illustrates clearly how program components are related to specific design solutions; it describes a design process for using this guide which can then be generalized by the reader to other design projects.


Developmental Goals
The reader can use the Developmental Goals section independently to develop his or her own facility program by selecting the goals most appropriate to the local conditions and users.
Activities
Activities mentioned in developmental goals and design principles might be used as a guide to choose appropriate goals, principles, and related design recommendations.
Design Principles
The reader can use the Design Principles section independently as a guide for design ideas and strategies. It can also be related back to developmental goals in order to establish a behavioral rationale for design choices.

How to use the design guide: entry to goals or directly to design principles.

Section 2
Design Guide: Developmental Goals and Design Principles

The design guide differs from a design program in two important ways:

- All the design recommendations are based on the developmental needs of children and on conceptualizations of the ways in which good design can facilitate behavior.

- It is generic and intended as a general guide from which any number of specific architectural programs can be derived for indoor and outdoor facilities.

The guide has four parts:

- User profiles -- to help designers gain an impression of the routines of exceptional children in their schools
- Anthropometrics -- charts of children's measurements and proportions on which to base detailed design decisions
- Developmental goals -- major objectives relating to all children but highlighting areas in which exceptional children have more difficulty; these goals can be facilitated through designed settings
- Design principles -- critical factors and characteristics for the designed environment.

The heart of the design guide is the design principles. An important feature of this guide is a matrix relating principles to the goals they are intended to facilitate. The matrix can be used to determine which principles to select for the design of a particular facility depending on the developmental goals and priorities of the adminstration and staff.

User Profiles

This section illustrates some of the typical situations and activities that users of exceptional education facilities face daily. These characterizations and experiences are composites of case studies; they provide some insight into the events and conditions that play a role in the life of the children, staff, and visitors.

Eric

A gust of wind throws Eric's hat from his head as he descends the bus in front of the St. Francis Children's Center. A staff member helps him retrieve the cap and they both move toward the entrance. Once inside, Eric recognizes his teacher and smiles broadly as she gently takes his hand.

Eric finds his own hook, hangs up his coat and gets help when he struggles with his boots. "This token is for getting off the school bus

Eric with a friend.

Eric at lunch.

Eric working with a teacher at the felt board.

properly, this one is for putting on your shoes nicely," his teacher tells him as she hands him the bright yellow plastic strips. She ties his token bag to his belt and he slips the treasured strips in. At the end of the day he will be able to trade his tokens for the prizes displayed on the board.

Without delay Eric is on his way to the Basic Skills Room where he and five other children gather around the activity pit to begin their morning singing game. Eric feels another boy squish in close to him and jostles him back as the songs begin. One by one the children announce their names and all of the children and three staff members join in singing the "What's Your Name" song. Eric's turn arrives to announce his name and for a while he hesitates to answer. His speech is slurred, but the name "Eric" is unmistakable when he finally gets it out. "Good naming, Eric," his teacher exclaims, and they all continue to sing.

A playdough game is next. Eric's teacher pulls a wad of the gooey substance into the air and he watches it slowly fall to the plate below. He pinches the mixture, not quite understanding how his teacher got the substance to ooze that funny way. She takes his hand and lifts it until the playdough falls. Eric giggles with delight.

Moving to the Motor Room, Eric practices his skills on the balance beam. One teacher helps him climb atop the beam and he tries to steady himself. This is very difficult, and after much effort he falls into his teacher's arms.

A reward for good behavior this morning is a trip to the SILC Center, the intriguing indoor playground. Once inside, Eric eagerly makes his way toward Playhouse 1. Up the ladder he climbs and immediately reaches for the yellow switch which he knows will turn on the light in the yellow fixture. He watches the reflective walls shine as he turns on the light. On-off, on-off, he flicks the switch, following with his eyes the route from the yellow switch along the yellow wire to the yellow light.

A trip across the connecting bridge takes Eric into Playhouse 2. "Soft, soft," he cooes, as he runs his fingers over the carpeted wall.

"Come on down the pole," his teacher calls. Eric looks down at the pole and the soft, green padding below. Fearing the drop, he races toward the slide in Playhouse 1 and slides down instead.

Other children have entered the playground and Eric joins some friends on the large, green water bed. Plopping down belly-flop style, he and two others undulate with the water's flow. Up and down, this way and that, they rock and sway and laugh.

Playtime leads into lunch time and Eric joins all the children for a hot meal. The lunch tables have been wheeled into the Motor Room. Eric finds his name and sits down with four other children and an aide. Today they are learning how to wipe their faces with a napkin. After lunch Eric returns to his classroom for a nap. Then it's class time again.

Scooting across the room Eric finds a cushion to sit on near the low chalkboard where the teacher writes, "Today is Washington's Birthday." He tries to repeat the words, watching Billy's lips as he moves his own.

Paging through books with a partner, pasting pictures of things that begin with "S" in his alphabet book, and naming objects the teacher puts on the table complete this period.

There's still time for more play, and Eric finds himself at the sand table in the Basic Skills Room. Shovel in hand, he tries to lift some sand but fails. Noticing his difficulty, a teacher helps him dig a hole. Excited over his accomplishment, Eric hurls a shovelful of sand into the air. Hair and clothes are now covered with sand and he must be brushed from head to toe.

The day has passed quickly and once again Eric finds himself with coat and hat in hand. His teacher helps him secure his hat so the wind doesn't blow it off. With a wave, Eric bids farewell to his friends at St. Francis.

Terri

The conversational rhythm is bouyant and free as a cluster of staff members gathers in the vestibule awaiting the arrival of the afternoon children. As Terri's bus pulls up, her curly blonde head can be seen bobbing about.

"She took her shoes and socks off," the driver announces as he slides open the door. Since the pavement is cold, Terri is carried in by a staff member.

Pattering barefoot down the hall, shoes in hand, she calls a greeting to some teachers and heads toward her classroom, the Basic Skills Room.

Somewhat reluctant to remove her coat, Terri does so when coaxed. But when two teachers attempt to help her put her shoes on, she whines, then screams. The screaming stops abruptly once the shoes are on, and Terri heads for the play area.

One teacher ties on Terri's token bag and gives her a token for hanging her coat up by herself.

Glancing at the bag, Terri heads for the giant

Having taken off her shoes, Terri is carried to the Center by a teacher.

Snack time and Terri is learning how to ask for more milk.

Lego blocks, dumps them out, and grabs a small mop, waving it in great circles in the air. Several children duck as a teacher retrieves the mop and talks to Terri. She throws herself on the floor in a dry-eyed wail, slapping herself on the cheek repeatedly. She will be ignored now until the tantrum is over.

Today Terri's schedule begins in the Motor Room where she works individually with a teacher. A big smile crosses her face as they get on the scooter boards and peddle across the gym floor.

"Let's go backwards now, Terri," the teacher calls. Terri tries, but doesn't succeed in propelling the board backwards. Within seconds she is on the floor screaming and slapping herself again.

"How about climbing the stairs," suggests the teacher. Terri knows she can do that, and gets up quickly to head for the stairs.

A volunteer picks up Terri to walk her back to her room and gently waits when Terri throws herself down in the hall to scream. She did not want to leave the Motor Room.

Most of Terri's afternoon will be spent in her own special area enclosed by folding screens, so that she need not contend with distractions and other children. Here she works on maintaining attention using a pop-up number toy. "Good sitting still, Terri," the teacher says and hands her a token when the period is over. Another teacher comes to her and they work at naming objects. Terris tries to repeat a few syllables.

When it's time for juice and cake, Terri takes her turn counting out cups for her table, and joins the other children for the break. When her cake is half finished, she grabs a handful and throws it at Julie. "No more cake for Terri," a teacher says and removes the cake. Terri hits the child next to her and is removed to her area where she tips over the table and chairs. She is soon down on the floor screaming. This tantrum lasts 12 minutes.

The afternoon is filled with speech therapy, more classroom work on language and attending skills, and self-help skills. Today Terri works on blowing her nose properly.

By three o'clock the group has regathered in the play area near the large windows. Terri stares sleepily out the window as the other children listen to a story and song record, joining in on the parts they know.

Today Terri selects a tiny fan for the nine tokens she has earned. Warm, comforting teacher voices surround her as she puts on her coat, clutching the fan. It's 3:15. Terri is heading home.

Geri

A sunny February chill is in the air as Geri gets out of her car and hurries up the walk to the main entrance. It's 7:45 and her day begins before she has her coat off. Two volunteers approach with questions on the day's schedule. Her quick enthusiastic voice bubbles on with the first of many explanations, directions, reassurances to volunteers, student teachers, and parents throughout the day.

Geri teaches in the Pool and Motor Room, and before her first class begins at 9:00 she chats with other staff briefly in the lounge. Coffee cup in hand, she heads for the Motor Room to arrange the equipment and check the day's activities. Instructions to student teachers, a chat with a volunteer mother, changing into her swimsuit, and Geri is in the pool by 9:00 with a mother and her 11-month-old infant.

Gently swirling the child in the warm shallow water, Geri encourages him to kick and splash as the mother coaxes. He squeals, cries, then laughs. Several mothers with infants are now in the pool with Geri and a student teacher, working in the relaxing warmth, encouraging the infants to extend their limbs.

At 9:45 Geri is back in the Motor Room. The first class has just arrived. Brian's shoe is dragging so Geri helps him with it before harnessing him up for the trampoline.

"One, two, three, jump, Brian," she calls animatedly. Brian bounces, struggling to maintain balance and counts with her.

Throughout the morning one group of children after another are brought to the Motor Room for balance and coordination skills -- batting balloons and soap bubbles, climbing steps, running, scuttling on the scooter boards, climbing, and following directions -- each according to individual need.

At 11:15 Geri quickly gathers up the last sponge balls. She will have until 12:30 for planning with student teachers and other staff, paper work, meetings, conferences with social workers, an audiologist, or speech teacher -- and lunch.

Then it's back in the pool with another mother and infant group, blowing bubbles and paddling on the kick boards. The remainder of the afternoon will be spent in the Motor Room.

It's her co-teacher, Renee's, birthday, and Geri stops to share some cake with Todd when he arrives. More classes, individuals, groups, and at 3:15 the last child leaves.

A parent stops her on her way to the lounge

Later, Geri works on motor development with an older boy in the Motor Room.

At the end of the day, Geri celebrates the birthday of her colleague, Renee, with one of the children.

and they chat about Michelle's recent setback. "There had been so much progress, and suddenly ...." They discuss the familiar pattern of progress and backsliding, and reassure each other of the overall progress Michelle has made since last year.

A phone call interrupts and by 4:00 Geri has made it to the lounge for a cup of coffee and a planning session with three high school seniors working on a class project.

The gray skies have grown even grayer and a light dusting of snow is falling as Geri, still smiling, prepares to go home. It's been a typical day.

Anthropometrics

Anthropometry is concerned with the measurements and proportions of people. Information about these dimensional characteristics of people is an important component in the programming and design of environments and equipment. It is especially critical when the fit between child and environment can determine the success or failure of their activities, and of the staff involved. Fit is even more critical for the handicapped, whose competence and ability to negotiate the environment is often limited. A chart showing typical data is on the next page. More detailed anthropometric data is available for all age groups in several good design source books, such as Goldsmith (1976) and Dreyfuss (1967).

Developmental Goals

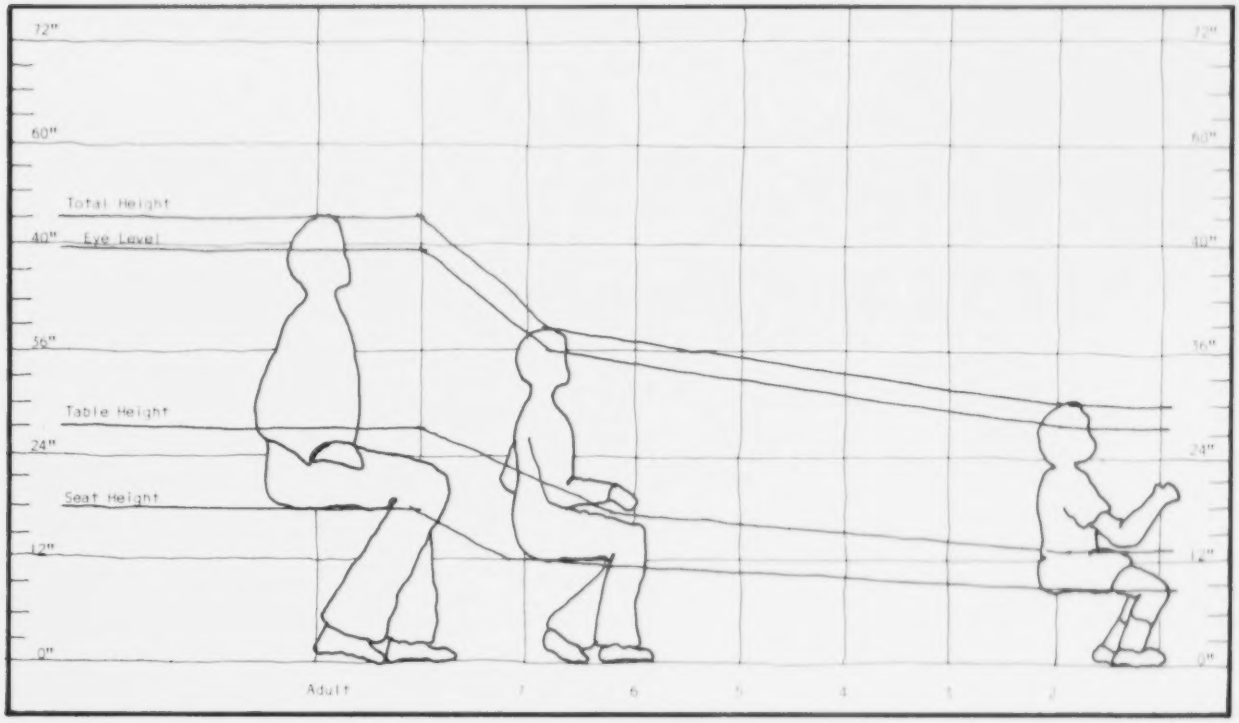
The development of human beings starts with conception and ends with death. The developmental pattern is the same for everyone, but the speed in which development occurs varies.

When this speed is extremely fast or slow, we start talking about exceptional children. In this context, we shall concentrate only on the slower development process. Disturbances can occur at any developmental stage, and they can be caused by physical, chemical, hereditary, emotional, or social factors, or a combination of these factors.

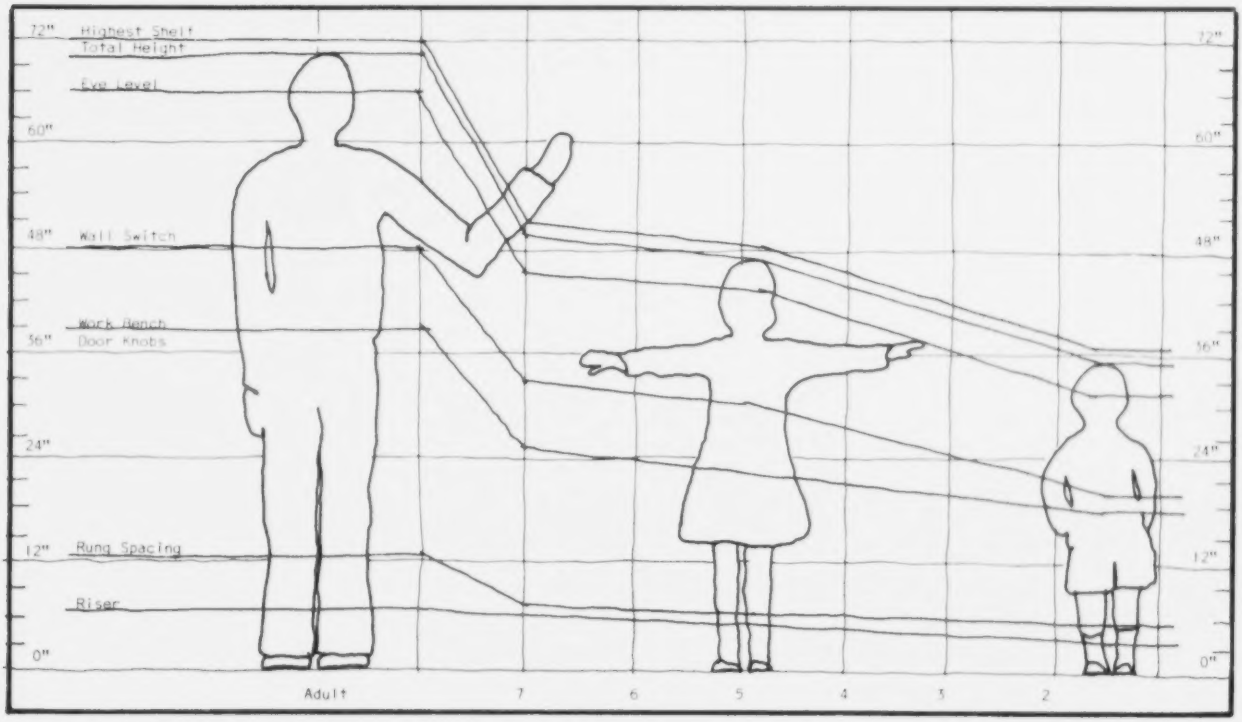
The variation among exceptional children is greater than among "normal" children. This is very important to keep in mind when dealing with exceptional children because they can develop in a normal speed in one area and be far behind in another. It is also important to keep in mind that every child must pass through the same stages and will not skip any stage in that developmental sequence.

There are several scales for evaluating a child. They depend on what the child is doing or able to do, and from this judgment a developmental age can be obtained. Knowing that age, and knowing the developmental progressions through which all children pass, one can start to stimulate the child and speed up the development.

With normal children, we trust that the develop-



Anthropometric chart for the 50%-tile male standing, from age 2 to adulthood.



Composite anthropometric chart for men and women sitting.

mental process will proceed according to its own timing system. With exceptional children, it is necessary to assess what skills they have and discover the appropriate mode by which they can develop the skills which they lack.

In this chapter, we discuss the three principal areas of development -- physical, intellectual, and social-emotional development. Then we examine 14 important goals, paying attention to their implications for design.

The Integration of Development

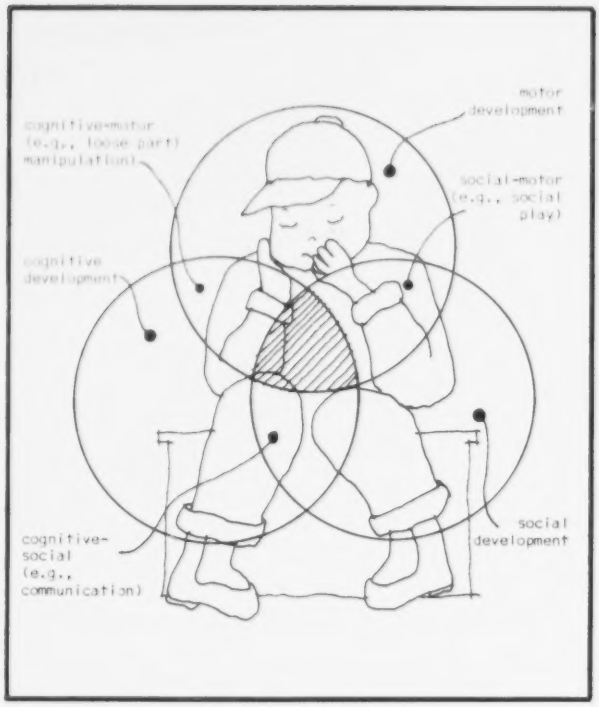
A child is an integrated being -- moving, thinking, feeling. Thoughts influence action, which in turn leads to emotional responses, perception, learning, and further action. The whole is indivisible.

Notwithstanding this indivisibility, it is possible for the sake of analysis to speak of three primary areas of the development of the individual -- physical or motor development, intellectual or perceptual-cognitive development, and social-emotional development including the development of personality. These three primary areas of development overlap, defining three other areas of secondary development, as shown in the accompanying illustration.

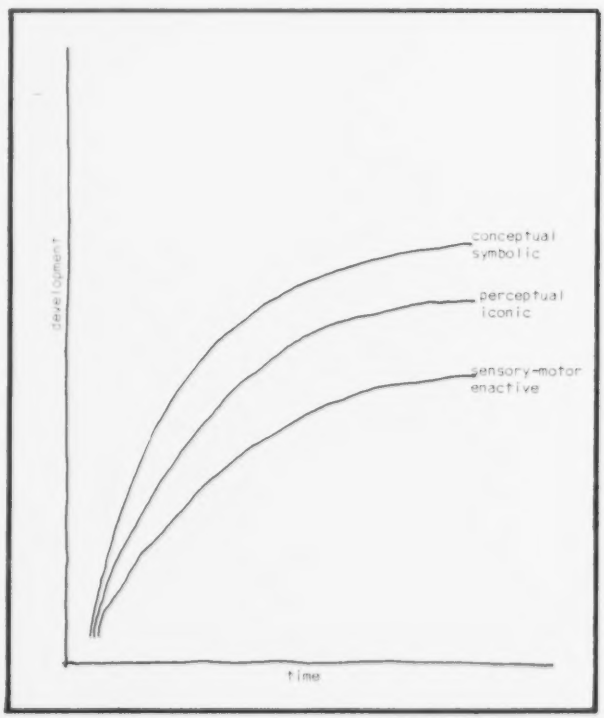
Heinz Werner, the internationally renowned developmental psychologist who was for many years at Clark University in Massachusetts, has given us a further conceptualization of development (Werner, 1948). He has shown that the development of action patterns in a very young child precedes and leads to the development of perceptual abilities and the higher mental processes (thought, reflection, problem solving, symbolization) in an older child. Basically, the conception is that cognitive processes develop from the internalization of perceptual and action responses, and that perception itself is a higher form of interaction with the environment than pure action. But action in and with the world is a necessary prerequisite for perception, which in turn is a necessary prerequisite for the higher mental processes. This conceptualization of the process of human development is shown in the accompanying illustration and underlies much of our thinking about design principles and the way in which facilities for exceptional children should be built.

The Identification and Organization of Developmental Goals

We have identified 30 important goals for exceptional education and the physical environment. They are shown (in no particular order) in Table 4.



The three main areas of child development.



The three major stages in cognitive development and symbolic representation.

large muscles
fine muscles
manual dexterity
eye-hand/eye-foot coordination
balance
locomotion
general coordination
perceptual-motor coordination
perception
form recognition
direction and orientation
exploration and discovery
awareness of natural environment
imagination, creativity, and problem solving
environmental manipulation and control
mathematical concepts
spatial concepts
classification and seriation
attention span
representation and social role playing
imitation and role playing
communication
cooperation and social play
body image
self-concept
self-initiative
ego development
emotional expression and control
handling environmental changes
language, speech, and hearing

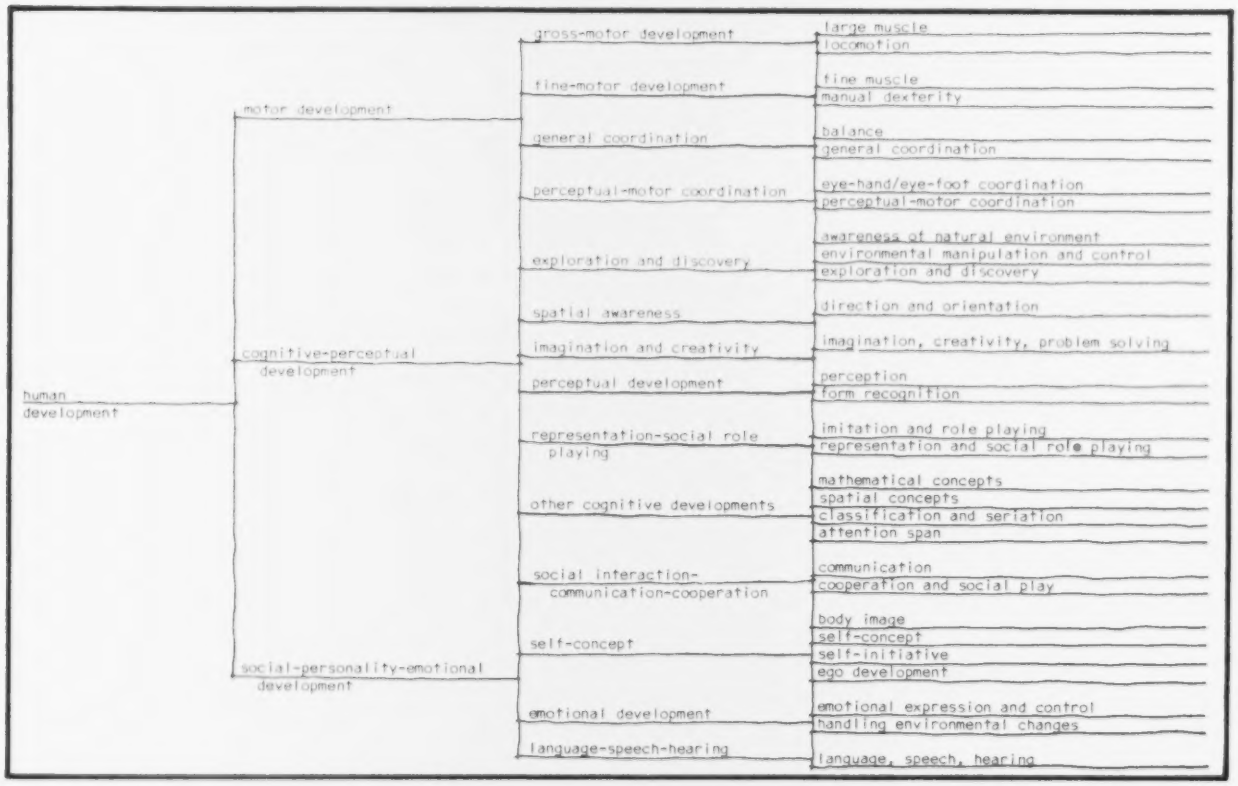
Unordered set of 30 important developmental goals for exceptional education. Table 4

It is possible, furthermore, to collapse a set of developmental goals into a hierarchical tree-like diagram which shows their interrelations and which shows how specific goals are subsumed under each of the three primary areas of human development.*

Developmental Progressions and Approximate Ages for Average Children

After identifying the major areas of development and their interrelationships, the next task is to identify benchmarks of development from birth through the end of the major developmental period. Though all children are different, it is possible to indicate a rough chronology of development in each of motor, cognitive, and social-emotional development.

* An organization could use this set of goals to determine its own priorities for design goals for facilities for exceptional education. Simply print each goal on a separate card and have members of your staff, parent groups, professional consultants, architect, etc., pick and defend certain goals in an interactive group. Continue the process until consensus is reached on the most important goals. Then use the goals to enter the matrix of design principles in the next chapter. This will lead your group to the definition of the problem and to a set of design ideas which should underlie any facility to suit your program goals.



Hierarchy of main areas of child development and major developmental goals.

AGE	MOTOR DEVELOPMENT	COGNITIVE DEVELOPMENT	SOCIAL-EMOTIONAL DEVELOPMENT
birth	creeping reflex, walking reflex --grasping reflex	reflexes, senses ready for experience	helpless, asocial--general tension
	head sags--hands fisted	first acquired adaptations	
1 mo			
	control of eye muscles, head steady --hands open	begins active exploration, perceptual-motor coordination of earlier reflexes, reproductive assimilation	visually fixates a face--smiles at a face--delight, distress
3 mo			
	control of head and arm movements --grasps purposively with hand and palm	new adaptations through familiar schemes, learns to grasp an object to produce effects; the object becomes an extension of the hands	distinguishes between familiar persons and strangers, no longer smiles indiscriminately--specific emotional attachment to mother
7 mo			
	control of trunk and hands, sits alone, creeps--inferior forefinger grasps	observational learning, imitates actions of others, explores what an object permits him or her to do	enjoys simple nursery games, responsive to own name--anger, affection
10 mo			
	control of legs and feet, stands, walks with help--forefinger grasp	discovery of new means by active experimentation, discovers new "means schemes" to use in goal-directed action sequences	waves "bye-bye", gives and takes object--fear of strangers, curiousity, exploration
1 yr	walks, throws a ball--builds 2-3 cube tower, makes lines on paper with crayon	trial and error exploration, invention of new means through mental combination	obeys limited commands, interested in his or her mirror image--dependent behavior, upset when separated from mother, negativism
2	runs, kicks a ball--builds 6 cube tower imitates circular stroke	discover new means through a covert process which amounts to internal experimentation, an inner exploration of ways and means instead of overt trial-and-error exploration, shows increased memory by imitating an act some time after having seen it	does opposite of what he or she is told, starts making friends--temper tantrums to 3 years, resentment to new baby
	jumps off a step, rides a tricycle--builds a 9-10 cube tower, uses crayons		talks, uses "I, me, and you", dependent, parallel play, gives orders, inability to make decisions--fear of separation, violent emotions, differentiates facial expressions of anger, sorrow, and joy, sense of humor
3	stands on one foot, jumps up and down --draws a circle and cross	preoperational phase (2-4 years): child egocentric, unable to take viewpoint of other people, classifies by single salient features: if A is like B in one respect, must be like B in other respects, language "explodes" and through that the way opens for symbolic mental activity, but the symbols used are rather undifferentiated totalities	
4	mature motor control, skips on alternate feet--copies a square and a triangle		likes to share, uses "we", cooperative play with other children, intense curiousity, asks questions--affectionate towards parents, romantic attachment to parent of opposite sex, imaginary fear of dark, injury, etc.
5	jumps rope assisted--good precision in use of tools, copies letters	intuitive phase (4-7 years): thinks in terms of classes, sees relationships, handles number concepts, but is "intuitive" because he or she is unaware of classification, gradually develops conservation in this order: mass (5 years), weight (6 years), and volume (7 years), uses adult speech sounds, masters basic grammar	prefers play with other children, becomes competitive--responsibility and guilt, feels pride in accomplishment
6	jumps rope alone--copies diamonds		independence of parents--basic emotions all established
7		imitation shows that he or she is interested in similarities, but they are mostly dependent upon perceptual cues	clubs, comic books, TV, friends become more important--emotions continue to develop in subtlety and connotative richness
8	constantly busy and active--practices and refines gross motor and fine motor skills	concrete operational phase (7-11 years): less egocentric, is able to go back to the starting point, for example to count from 10 to 1, behavior becomes differentiated in taking consideration of the totality and parts, realizes that there are logical necessities, organizes objects into hierarchies	
9-11			

Stages and phases of development for each of the three major areas of development and approximate age ranges.

Flying down a cable run. Coordination, rhythm, and balance are necessary for this favorite children's game.

Children with motor development difficulties try simpler motor games.

These developmental descriptions are based mainly on the theories and research of Jean Piaget (see Flavell, 1963; Hart & Moore, 1973), Jerome Bruner (Bruner, Olver, & Greenfield, 1966), Arnold Gesell (Gesell, 1940; Gesell & Ilg, 1946; Johnson & Medinnos, 1974), and Frances Ilg and Louise Bates Ames (1955).

The chart is not a comprehensive detailing of all the processes and stages involved in the child's development, but it does show the characteristics of various stages during the overall developmental process. The ages given are not meant to represent an absolute point of development, but rather the average age span when these characteristics may be observed in average children.

Motor Development

Gross-Motor Development

Gross-motor development is the ability to stand upright, balance in various attitudes, walk, jump, etc., and generally to control the arms, legs, and trunk.

Not all exceptional children have the same gross-motor difficulties, therefore a wide range of activities must be considered. A child may have only a minor motor difficulty in one area or several severe difficulties. The most common is poor endurance (Gordon, 1972), either physiological or induced by overprotection. These children often have more fatty tissue than average and are weaker in muscle and bone structure. Poor coordination, rhythm, and balance, lack of agility, and perceptual-motor difficulties are also common problems (Kephart, 1960; Cratty, 1970). Less physical, though related, is the withdrawal and absence of self-initiated activity which is often due to a history of motor and sensory-motor failures.

Through play, children may gain some of the basic needs to achieve gross-motor development. Play can motivate the child to use skills recently mastered and move in many different ways through three-dimensional space. For example, after sitting has been accomplished, creeping, crawling, standing, and, finally, walking are attempted. The activities become more complex, each requiring more static and dynamic balance and greater muscle strength and control.

Though motor activities are overemphasized on traditional and most contemporary playgrounds (Moore & Rose, 1976), there is considerable evidence that gross motor activity is the basis for all higher order developments like perception and cognitive structuring of the child's world (Werner, 1948; Kephart, 1960; Piaget, 1963; cf. review in Hart & Moore, 1973). The development of posture is not only important for the development of locomotion, but also for the development of the understanding of spatial relations (Ayres, 1972).

A wide variety of environments are called for which stimulate motor development, and in particular which call upon, and therefore provide "aliment" or practice for endurance, balance, locomotion, coordination, agility, rhythm, and perceptual-motor coordination.

Fine-Motor Development

Skills in fine-motor development are necessary for grasping and manipulating objects. Most self-help skills such as dressing and brushing teeth, and academic skills such as writing, are dependent on fine-motor ability. Children with

Working on a superb perceptual-intellectual task—a collage—in a lowered, quiet activity nook. St. Francis Children's Activity and Achievement Center, Milwaukee, by Brust-Zimmerman, Architects.

Exploration and discovery for a 1 year old. The natural environment provides so much for children to explore and to learn about.

learning disabilities are likely to be slow in acquiring fine-motor skills and may lack accuracy and coordination of fine-muscle activity. Exceptional children should be provided with surfaces, textures, and objects of various shapes, weights, and consistencies (Cherry, 1976). The objects should be interesting and attractive to children and should invite manipulation. Clay, sand, building materials, and art supplies provide experiences in which a child can exercise finger, hand, and wrist muscles.

Warm water has a highly therapeutic value as a play medium. The warmth relaxes stiff finger muscles, making them more flexible and thus encouraging the child to continue with the activity. Equipment and activities that encourage children to grasp or drop objects, such as plunking stones in a can or a pond making an enjoyable sound, assist children in repeating sequences of finger activities.

General Coordination

General coordination is skillful and free movement resulting from the harmonious working of muscles and muscle groups. It develops similarly to, and is dependent upon, gross-motor development.

The three components of general coordination are rhythm, agility, and balance (Cratty, 1970).

Exceptional children often cannot counterbalance when creeping and crawling, or pattern a left leg-right arm and right leg-left arm movement. They also have poor equilibrium reactions and poor maintenance of dynamic balance. A child may have problems in jumping and hopping if unable to control symmetrical (right and left together) and independent movements.

Children must be provided with opportunities to regain balance in sitting or other positions during play. Scooter boards, slides, perches at varying levels, rocking and bouncing toys, a waterbed, and a trampoline all require the child to regain equilibrium in various positions (Ayers, 1972; Kephart, 1960).

The development of these coordination skills may be further assisted by providing inviting opportunities for children to crawl through and over things, to balance in different ways, and to move through space in a variety of activities.

Perceptual-Motor Coordination

Exceptional children often have perceptual-motor problems and difficulty identifying left-right body dimensions and determining when an object is to their left or right. Static and dynamic balancing also pose problems. Similarly, fine integration and synchronization of muscle groups which is necessary for efficient play performance and some classroom tasks is difficult for exceptional children.

Cognitive-Perceptual Development

Exploration and Discovery

Exploration, the process of searching out and investigating the unknown, is one of the most exciting and rewarding elements of children's play. It is also an important part of overall intellectual development. Concepts learned in this way are reinforced through the experiences of discovery and of success. When this exploration is spontaneous and self-initiated, as in free play, the value of the experience is greatly enhanced.

Fantasy play in a puddle on the edge of a roadway (here interrupted by the camera).

"Loose parts" are ideal material for explorative play if they can be manipulated by children. Examples of loose parts are building blocks or boards, cardboard boxes, snow, mud, dirt, sand, water, and fallen leaves. Children choose and use for long periods of time play settings and objects that enable them to explore and manipulate and which respond immediately to their actions.

Some of the best materials, and most sought after by children, are found in nature (Hart, 1974). Contact with nature is especially beneficial to the exceptional child. The human response to the direct stimuli of nature is probably inherited and unconscious and therefore not susceptible to distortion by emotional or other mental disturbance. Children with developmental disabilities are often over-protected in their home and school environments, to the extent that, through the best of intentions, they are deprived of opportunities for exploration and discovery. Being shielded from the rough outdoors, from messy play environments, from extraneous stimuli, they are deprived of a rich source of experience and are unable to learn how to deal with these aspects of reality. Experience of nature alone, or simply being outdoors, may produce a response toward normal functioning (Iltis, 1973).

Spatial Awareness

For all children, an awareness of body positions (behind, in front of), locations (above, below), and distances (near, far), is developed through repeated experience of moving in space with appropriate labelling of locations and relationships (Piaget & Inhelder, 1956). Because of the protective limitations imposed on exceptional children, the opportunity to move freely through space and to experience varied locations and positions is often minimal.

To support a developing awareness of spatial relations, children need the opportunity to view things from varied perspectives. It appears that children prefer to be in spaces three to six feet above the ground from which they may view many things and activities (Shaw & Robertson, n.d.). A variety of heights, vantage points, places in which to experience changes in body posture, to experience the feeling of being above or below someone or something all support the refinement of spatial awareness.

Since exceptional children are easily confused, it is necessary to provide an environment that clearly defines separate activity areas. Environmental cues should be provided to assist a child in locating himself or herself in space. One prerequisite to play is security. Children must know where they are in relation to other things and people before the freedom to play can be activated.

Imagination and Creativity

Imaginative play includes all make-believe games, activities, and dreams that transform the child or his or her reality. When a stick becomes a loaf of bread, and the child a parent, he or she is not only transforming the object but also transforming oneself into the person being modeled.

Manipulation of the environment is one means of feeding and expanding children's imaginations. By using cardboard boxes, wood, tools, and other loose parts, the child is designer and builder, and creates a product which is his or her own and can serve other purposes. Sand and water play, building materials, a changing environment, creative songs, stories, and dances, and pretending, are all ways of expanding and using a child's imagination, which in turn positively affect the child as a whole person.

Perceptual Development

Exceptional children may experience distortion in their perception of visual, tactile, and auditory stimuli and may have difficulty processing them. To assist these children, their environment must have a variety of stimilu presented in an orderly and consistent manner. Repeated geometric shapes, colors, and pathways, varied textures of hard, soft, or resilient, and sounds, letters, and talking all support a child's involvement with the environment.

To operate successfully in a building, whether it be a school, a playground, or the home, a

child needs to be able to read that environment. With regard to visual perception, this includes depth perception, size and shape discrimination, color recognition, and recognition of spatial relationships such as above, below, next to, behind. The exceptional child may experience distortion of visual input or some impediment to the normal processing of this information. But when a learning-disabled child experiences one change in sensory cues, such as distinctly different colors in adjacent carpets, he or she expects another physical change, such as a change to floor level. These observations begin to suggest that to support perceptual development two qualities of the physical environment are important: visual stimuli should be presented in an orderly and consistent manner; and there should be a repetition of multiple cues so that if color is discriminated by a child before depth, it can be an aid (and not a hinderance) to depth perception.

Representation and Social Role Playing

In imaginative play, activities or persons involved in the activity are represented as something other than what they really are. A child's make-believe world is almost real. It is close and easily accessible, and the child only needs to pretend. Social role playing involves the child being able to represent other people and social situations. Role playing games and social pretending help the child to understand complex interpersonal and social situations (Garvey, 1978).

Novelty and change in children's environments contribute to fantasy and imaginative games (Moore & Rose, 1976). Thus, among other qualities, children's environments must range from ambiguous to defined so that each child can create a private and wonderful representation of a different "reality" through imitation, imagination, pretending, and role playing.

Other Cognitive Developments

In addition to the foregoing, children have to develop skills in classification, seriation, concepts involving quantity and time, spatial concepts, attention span, and problem solving. They must be able to recognize similarities and differences, put things into order of size, weight, or color tone, and comprehend quantities, relative positions, and changes in time.

Heavily influencing the development of all these cognitive processes is the child's ability to focus on a task and exclude extraneous stimuli. Little can be accomplished without an appropriate attention span. Extraneous stimuli must therefore be masked from activity areas intended for concentrated cognitive pursuits. To support many cognitive developments (e.g., classification and seriation skills), the child's environment must provide a variety of elements and a repetition of cues and opportunities to repeat an experience in a variety of ways. Rich environments that invite manipulation will facilitate the child's understanding of the properties of objects and the principles that govern their use.

A stage for role playing—puppet shows, informal drama, and spontaneous fantasy play, Wildwood Preschool, Boulder, Colorado, by Robert Lewis, Designer. This children's center is built partially underground and resembles a rabbit warren in layout and shape of its spaces. It was designated a demonstration site for the 1979 International Year of the Child. (Photo courtesy of Robert Lewis.)

Other cognitive developments may be aided by building and landscape design. An understanding of the passage of time (days, seasons) and spatial concepts (between, above, below) may be supported by repeated experiences in a natural environment that allows the child to perceive changing sun patterns, seasonal changes in nature, changing wind directions, and other siting and landscape elements.

As the development of the child's understanding of spatial concepts -- both the spatial perception of objects and the spatial cognition of environments -- proceeds through a series of well-defined stages (see Hart & Moore, 1973; Moore, 1976b), many exceptional children will have difficulty finding their way about buildings and outdoor areas without clear images, clearly structured reference systems, and clear orientation systems.

Because exceptional children are overprotected and guided by adults, they don't have many opportunities to solve problems without adult interference. Yet, to attain self-sufficiency and competence, they must experience and solve child-scale problems. Therefore, the environment must provide safe areas for free play activities (to deter adult overconcern) such as building, gardening, and exploring. It must allow children to interact with a variety of ob-

Quiet spaces and places to retreat for a while can be invaluable for the development of a positive concept in all children, not just exceptional children. The National Child Research Center, Washington, D.C. Renovations by Chapman & Miller, Architects.

jects and natural elements, to experience cause and effect relationships, and to see themselves as agents of change who are capable of dealing with the environment.

Social-Personality-Emotional Development

Self-Concept

Children with developmental lags, whatever their type or case, need to develop a positive self-concept -- one of the most important developmental goals for exceptional education. Opportunities should be provided for exceptional children to find out about themselves, to recognize and identify body parts and develop a body image, to imitate the acts and movements of others, and to experience positive achievement from their own movements, actions, and paced accomplishments.

We are not born with a concept of self -- as new beings children cannot distinguish between self and surroundings. Through repeated experience and sensation we learn that those waving arms and the hungry tummy were part of self; the blanket was not. Secure arms, warm smiles, and soft coos told us the self we were learning about was a joy to others, and thus self became a joy to us. As others delighted in our growing accomplishments, so we delighted in our own. As others showed confidence in our trying and achievement, and were not distressed by our occasional failings, so we continued to try and achieve. Each skill, each success, brought its own reward, a delight in our coming to terms with our surrounds, a delight in our own growth, a delight in our self.

For the normal child there are periods of disequilibrium, when aspirations and accomplishments teeter-totter, when the wanting to ride a bike so far exceeds the capability to ride the bike that frustration erupts into tears or aggression. For the child with learning disorders, such disequilibrium is resident. If there is any universal concurrence in the developmental literature, it is on the critical importance of a positive self-concept. For the child with developmental lags, whatever their type or cause, the growth of a positive self-concept is even more critical -- the exceptional child has a persisting motivation to try, but a considerably more difficult time to obtain a stable and positive self-concept.

For the designer faced with the task of designing a facility for children with such special needs, a consideration of self-concept must pervade.

Any supporting environment -- a special school, an early childhood center -- must out-shout the exceptional child's inner frustrations and it must be designed to provide success (i.e., graded challenges, paced alternatives, and clear accomplishment points). It must be receptive to the child's actions and also provide varying degrees of challenges so that accomplishment is possible for each child no matter what their skill level.

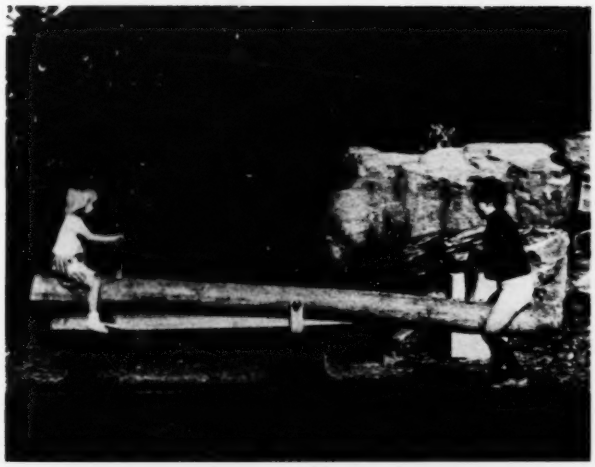
It must reward the child for skills -- the whoosh of the slide after the strenuous climb -- and it must provide alternative ways of accomplishing the same act for children whose capabilities and behavioral modes vary widely (Moran & Kalakian, 1979). A play environment for exceptional children must provide sufficient ambiguity and a variety of more well-defined elements for flights of fancy and imagination to thrive, for the therapeutic regeneration of the child's playful escape from reality.

The requirements for the development of a stable self-concept influence many of the design principles later in this section and underscore its importance as an overriding concern in the design process for exceptional children.

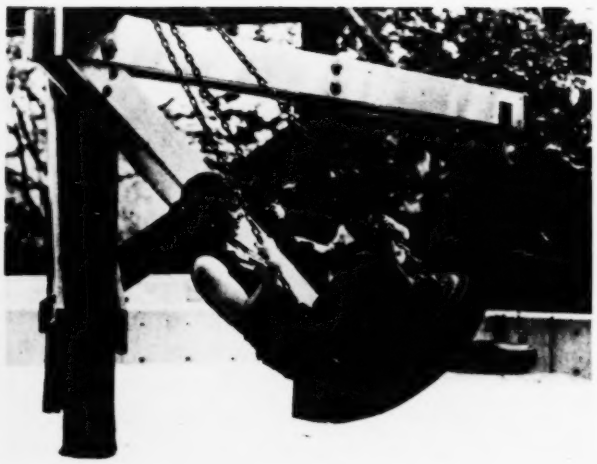
Social Interaction, Communication, and Cooperation

Many exceptional children are so withdrawn and inner-focused that it is difficult for them to share a feeling or play cooperatively with another child. Often these children need and want physical and personal closeness, but have not learned how to communicate or translate their need to others.

Socialization can be thought of in three devel-



The archtypal example of cooperative play equipment—a see-saw at Peacock's Point Park, Balmain, Australia.



A tire swing, too large for a single child to swing, but just right for a teacher and a child to work together. The Adler Playground, New York, by Richard Dattner, Architect.

opmental stages: individual activities; parallel activities; and cooperative activity (Millar, 1968). Design-related problems which can hinder the development of social interaction, communication, and cooperation include visual and aural distractions which hinder already-difficult communication, interruptions by adults and other children when children are trying to engage in cooperative or even parallel activities, and too few opportunities and encouragements for cooperative play.

To develop social skills, the environment should encourage children to come together for modeling, pretending, group games, cooperative activities, and manipulative play. Children need places for playing house, playing "mommy and daddy," and dressing up. They also need cooperative activities such as teeter-tottering and playing on a giant tire swing which can only work if two or three children cooperate together. As such interaction is relatively difficult for the children, the environment should make socialization and cooperation less stressful, easily accomplished, and attractive.

Emotional Development

Children develop emotionally by learning to handle and communicate their feelings. The play environment should help development by requiring the children to interact, cooperate, observe, and share activities with each other and adults. These requirements are particularly important for exceptional children since they often are withdrawn.

However, provision must be made for children to withdraw occasionally so that they can recharge their energies and observe their peers. Connected retreat areas should be provided for autistic children who are timid and avoid social interaction in crowded conditions.

Exceptional children who are hyperactive and who must follow highly structured behavior patterns during the indoor school day should perhaps have opportunities, equipment, and acceptable areas for energy discharge and emotional explosion outdoors in a less-structured play environment (emotional release areas). These areas should include items on which the children can vent their aggressive tendencies, tensions, and even violent feelings in a socially acceptable manner (Abeson & Blacklow, 1971; Moran & Kalakian, 1974; Cherry, 1976). Equipment can include large, inflatable plastic toys like punching bags, lightweight blocks to build up and knock down, inflated trampolines, and spaces where the children can jump, run, and move vigorously (Allen, 1968; Moran & Kalakian, 1974; Cherry, 1976).

Language, Speech, and Hearing

Speech and language skills can be improved through social interaction in structured group activities and imaginative free play. To help children discriminate auditorially, the environment needs devices or toys that make sounds when they are moved, apparatus that permits a child to create a variety of tones with different movements, opportunities to hear natural sounds such as wind rustling leaves, street noises, and the sounds of children playing at varying distances.

Design Principles

The central part of the design guide is a set of design principles derived from the developmental goals and supporting behavioral information.

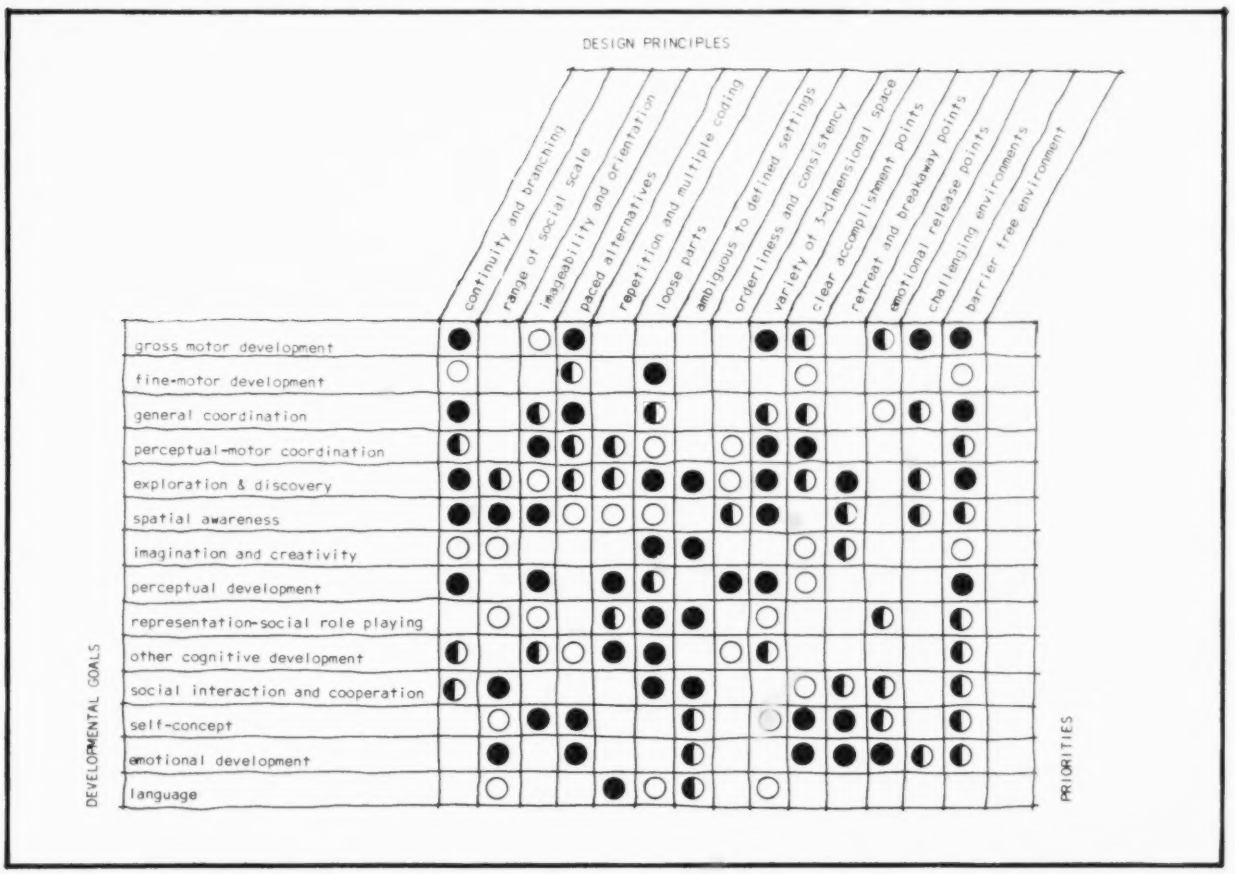
Design Principles and Human Development

The following design principles apply to environments for all children — exceptional and average -- though they clearly are more critical for exceptional children. They apply equally for indoor and outdoor play/learning settings. The case study in Section 3 shows their application to the design of an outdoor play/learning environment for children with a variety of special needs.

Children do not want overly simple plans, singular organizing principles, and the like. Although exceptional children require space to be more clear and orderly than do other children, designs for children should not be dictated by the modern idioms of simplicity, functional clarity, articulation, and "less is more."

The principles are not just requirements for the design of specific spaces or things in a child's environment. We have not tried to duplicate or even extend such standard references as Time Savers Standards or the other building and recreation source books. We also have not focused on environmental control criteria or other quantitative criteria of good building design. Previous design guides have covered these topics extensively (see Osmon, 1971; Texas A&M University, 1969; and Ries, 1973).

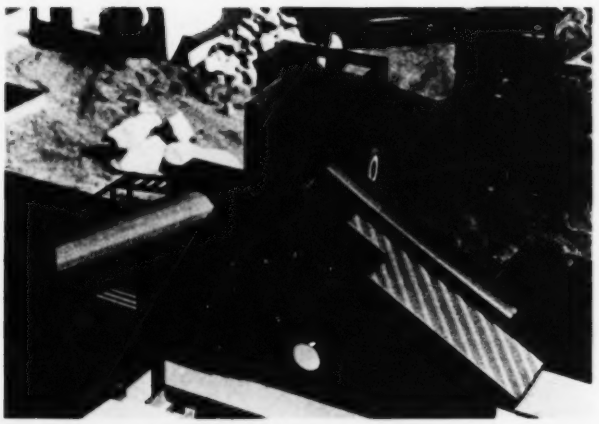
Rather, the following design principles suggest general attitudes toward design. They are overriding principles -- each one is capable of affecting all of the design of a facility, not just one place or part. Taken together and allowed to provide the basis for the major design decisions about the overall organization and character of indoor or outdoor facilities, they have the potential to greatly affect design and



Design principles and the major developmental goals they satisfy. Given a set of developmental goals important to a particular institution, school, or community group, this matrix can be used to select the most important design principles to use in developing a master plan and schematic design proposal.

to suggest solutions quite different from the current run-of-the-mill architecture and landscape architecture for exceptional children.

A matrix showing the relationships between the developmental goals and each of the 14 derived design principles is followed by detailed presentation of each of the principles and a case study illustrating their application. The principles are organized in three sets: (1) those bearing primarily on the organization and character of the facility as a whole (building or outdoor play space); (2) those bearing on the design of specific activity spaces; and (3) those bearing on the design of equipment, moveable parts, and details.



Continuity and branching in a project for the St. Francis Children's Center Outdoor Play/Learn Environment. An immediate choice of activities greets a child at the end of any sequence of other activities and activity spaces loop back on themselves so there are no dead-ends.

Continuity and Branching

Principle

The environment should allow for play and behavior to flow actively and continuously with multiple branches. Alternatives should be offered so that children can make decisions before taking the next step. A choice of options should be presented immediately at the end of each activity or cycle of activities.

Problem and Justification

Traditional playground equipment and closed-plan schools and day care centers are self contained and static. When a child completes one activity there is no branching possible into a related activity. Observations by Shaw (n.d.) indicate that activities which dead end or open onto an undefined play area diminish a child's level of motor activity; they may also diminish intensity, decision-making opportunities, and attention span.

On the other hand, in an ideal play yard, when a child climbs to the top of a slide and sails down to the bottom, there should be an immediate choice of activities in addition to a repitition of the slide cycle. In open-plan classrooms with several interconnecting activity centers, the child's spontaneity and opportunities for spatial decision-making are greatly expanded by the cues given by the space.

This principle gains support from several empirical sources. Suzanna Millar (1968), for example, points out that young children have some difficulty with sequencing tasks. As children become older, however, they become more selective and are able to choose elements, series of tasks, and routes. Other experienced authors in the child-environment field also recommend encouraging movement from activity to activity and the sequencing of spatial tasks (e.g., Cherry, 1976). John Holt (1974) suggests that paths from activity to activity should become parts of the play environment as well. Catwalks, he believes, should entice children to use them as play space as well as for circulation.

Therefore, when a child has come to the end of one activity or a cycle of activities, there should immediately and obviously be a choice of continuing options.

Application of this principle would be expected to support and facilitate several important developmental goals (see the matrix). For example, by providing a number of alternatives, branching off into new activities, the child may be encouraged to continue a series of interrelated activities, whether they be gross-motor play activities, cognitive exploration and discovery, or social role-playing and fantasy. If a child is faced with having to make decisions after finishing an activity, perceptual development, spatial awareness, and other cognitive developments may be enhanced. Thus continuity and branching can support a range of motor activities and a range of cognitive abilities like exploration, discovery, decision-making skills, increased attention span, perceptual development, and spatial awareness.

User Requirements

- Children should be able to see alternative directions and activities when they terminate an activity.
- Children should be able to withdraw into their own private world when they choose.
- Activities and attention span can be controlled by using intentional divisions or barriers.
- Activity areas should be clearly defined.
- Over stimulation should be avoided at decision points.
- Connections and links should be understandable to the exceptional child.
- Adequate environmental cues should be provided for children to understand where to go, how to use equipment, and how to understand the environment in general.
- Children should be able to see and understand the parts as well as the whole.
- There should be high places and low spaces (overviews and underviews) as well as in-between views.
- Fragmented play structures decrease overall use.
- Branching should take place up and down, sideways, and in other more complex ways.

Range of Social Scale

Principle

To provide variety in activities and interpersonal experiences, many exceptional children need variety in the size and configuration of their spaces and in their social groups. Places appropriate in size and scale for one child, two or more children, larger groups, and child-adult combinations should be provided within play spaces and indoor activity spaces.

Problem and Justification

Exceptional children often suffer from a lack of a range of group experiences and spaces appropriate for different sized groups. Designers, on the other hand, often forget about the privacy needs of children in schools, child-care centers, and playgrounds.

On the side of the need for small, intimate spaces, the exceptional child wants nothing better than closeness and warmth (Bednar & Haviland, 1969). There is some evidence that exceptional children may be more subject to the effects of crowding than average children (Ricker, n.d.; cited in Bayes, 1967). Although preschoolers usually appreciate visual closure for privacy, retarded children have difficulty distinguishing between different types of privacy and their provision in designed settings (Bayes & Francklin, 1971). Children also need places to work alone, to do task-oriented activities, and to dream for awhile (Gordon, 1969).

There is always a need for spaces for a child and a staff member to work one-to-one, and for small groups of three to five. We know from research that most spontaneous groups in outdoor open space are composed of three to five persons. It has also been argued (Millar, 1968) that the best size of a preschool play group is from two to four children.

On the other hand, many exceptional children also suffer from a lack of large group experiences. Older children especially need places for open play, running, and sports, even to the extent that half of the children should be able to play team sports at one time (Ontario Department of Education, 1971).

When many kinds and scales of spaces are provided, the opportunity for different social groupings increases. Solitude and physical togetherness can be experienced in small spaces, and without large open fields team sports cannot be organized. Pupil and teacher can work intently without interruption in a buffered space, and children can work cooperatively when the space is large and open enough for them to see the activity of others.

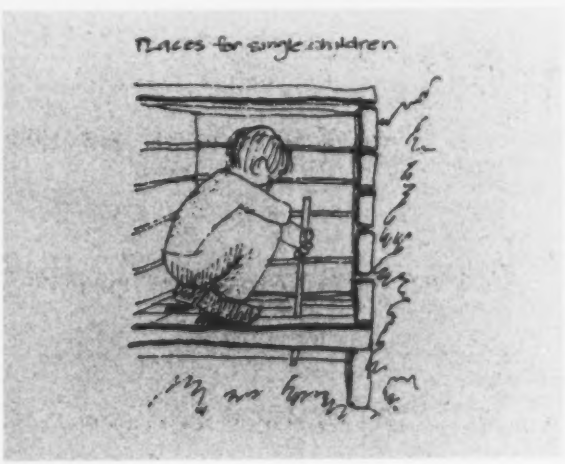
Range of social scale—one setting at the Washington Environmental Yard, Berkeley, California, by Robin Moore and Herb Wong. (Photo courtesy of Robin Moore.)

Range of social scale. (Drawing by Tim McGinty.)

Successful designs will help facilitate a variety of social and emotional developments in the play environment. Increased interest in play may come from greater social interaction (Moran & Kalakian, 1974). Shared social experiences may also yield communication or the desire to communicate (Handicapped Adventure Playground Association, n.d.). Being alone and learning to accept oneself and others is also basic to the social and emotional development of a stable self-concept.

User Requirements

- Provide a variety of spaces from small to large in any environment designed for children.
- Private spaces should be easily established and owned by children in different ways.
- Different and multiple ways of enclosing space should be provided.
- Places should be easily accessible from other activity areas for free, spontaneous, and solitary play.
- Provide nooks and crannies for single children.
- Many variously equipped places should be provided for two-person activity, and some situations ought to be included which need two or more children.
- Purposeful places should be provided for the staff and childrn to be together and to cuddle, such as at the end of a task, of to work or talk together.
- The size of the environment and the stimuli must be manipulable and controllable by the teacher in some teacher-child situations.
- Open spaces like a field or track are needed.
- There should be enough grass play area for half the children at a time to play team sports.



A range of social scale: places for single children.

Imageability and Orientation

Principle

Exceptional children need proper cues to help them perceive and understand physical spaces, time, direction, and relationships. The environment should be clearly imageable and have clear orientation based on vertical and horizontal cues and landmarks.

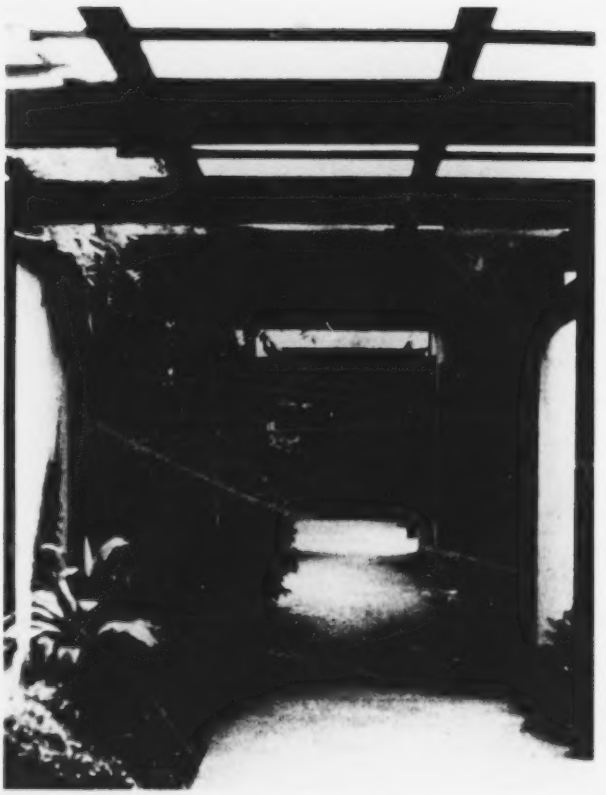
Problem and Justification

Some exceptional children have difficulty finding their way through buildings because they cannot easily and quickly organize in their minds sequences of time and space. They also may have difficulty with sequences of verbal and spatial directions and with mentally forming a meaningful whole from separate experiences (Kephart, 1960; Cruickshank, 1977). Therefore, the parts of the environment should be clearly presented so that the whole space can be easily recognized. Easily understood cues can also help children to develop a clear cognitive map of the environment and to relate perception to memory.

In addition to being clear, the environment should not threaten children but should induce them to explore it and thereby improve other cognitive abilities. Unnecessary ambiguity -- stimulating to the average child but potentially confusing and frustrating to the special child -- should be avoided (Bayes, 1967; Bayes & Francklin, 1971; Bednar & Haviland, 1969).

User Requirements

- Cues should be provided to make the environment understandable, e.g., color and level changes, numbers, repeated representative elements, and so on.
- There should be visual consistency within spaces.
- The sequence and scheduling of activities should be clear to the child.
- Multisensory cues should be provided for children with sensory handicaps.
- There should be a range of settings with variably controlled stimuli; irrelevant stimuli should be controllable.
- Visual images should be made clear.
- The sight of sky, trees, and leaves should be very prominent; windowless environments should be avoided.
- Glass doors that look like windows, identical push and pull plates, and panel doors in panel walls are examples of architectural ambiguity that should be avoided.
- As far as possible, elements with set functions and meanings should be minimized, and controlled ambiguity should be maximized.
- Spaces should be well defined; caution should be taken when spaces are not clear and where they merge together.
- Environments should be as complex as possible without overburdening the children's cognitive abilities.
- There should be a marked change between the indoors and the outdoors.
- There should be many opportunities for a variety of spatial experiences such as crawling through spaces, climbing up through different shapes, looking up into and down from spaces, etc.
- There should also be a variety of child-scaled environments that allow different movements such as straight/curved and fast/slow.
- The children must be able to personalize part of the environment so they can attach meaning to it.



Clear orientation and imageability at the Harold E. Jones Child Study Center, Berkeley, California, by Joseph Esherick, Architect.

Paced Alternatives

Principle

The play environment should be designed to stimulate and advance children's skills but not put unreasonable demands on their ability if they can't keep up the pace. Environmental stimuli can motivate children to move to the next skill level.

Problem and Justification

Environments with which the average child can cope are often frustrating or impossible for a child with reduced competence. The exceptional child should not be frustrated by the environment. On the other hand, the environment should have prosthetic qualities to suit special user groups but still provide enough challenges to stimulate and maintain activity (Ayers, 1972; Cratty, 1974). For example, a home and work environment for the blind which totally compensates for their handicap will not require any personal effort, and so the blind person's self guidance skills might soon be lost through lack of use. This required intensity of challenge has been called the "pacer" (Lawton, 1972).*

Exceptional children, furthermore, have a great need to gain a feeling of self-confidence and a positive self-concept. Feelings and self-concept can be seriously damaged if children never reach goals which they set for themselves. Maximum development results from an optimal discrepancy between the child and the environment -- challenges are made to existing motor, cognitive, and social schemes, motivating the child from one level of development to the next. Low self-concept reduces incentive to perform mental and motor tasks; to step up performance, children should be given tasks at which they can succeed -- the success will lead them to attempt more difficult tasks (Cratty, 1974). Success at such gradual paced challenges can also help to break the frustration cycle so common to exceptional children.*

Increased or graded complexity is a powerful means of providing for the "pacer." Graded challenges and paced alternatives assure the involvement of all children in play, motivate children to further development, and support a positive self-concept.

Paced alternatives, some easy, some hard, but all leading to the same place, at the Miami United Cerebral Palsy Exterior Sensory Learning Environment by Leland Shaw and Nan Plessas. (Photo courtesy of Leland Shaw.)

Paced alternatives. (Drawing by Tim McGinty.)

* From an unpublished lecture given at the University of Wisconsin-Milwaukee, by Amos Rapoport, fall, 1976.

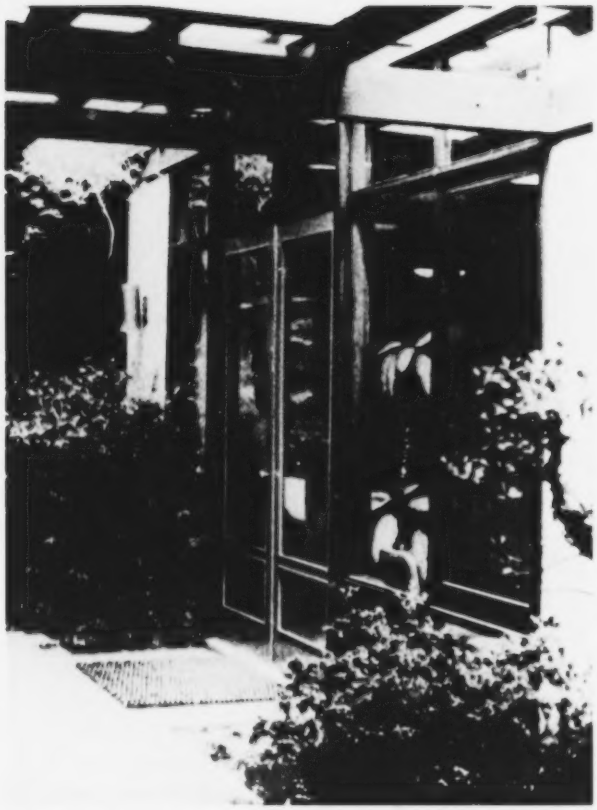
* From a staff interview at the St. Francis Children's Activity and Achievement Center, Milwaukee, October 1976.

User Requirements

- Small parts of the environment should provide challenge to develop long-range skills.
- Challenge should be experienced in a variety of ways.
- For each type of activity, there should be several levels of accomplishment, e.g., climbing a ladder, climbing a cargo net.
- Play experiences should provide an awareness of challenges ahead without being intimidating --children should be able to see new challenges and accomplishment points ahead when completing a cycle of activities.
- Interest and success must be maintained by activities and space.
- There should be some portions of the environment designed to the scale and skill level of infants as well as for children up to 13 years of age.
- Older children require less emphasis on balance, general coordination, and general physical activities; more emphasis should be placed on complex and paced cognitive challenges.
- The play environment should provide for similar activities to occur at different rates without interfering with each other.

The following requirements are in conflict with the overriding need for obtaining challenge. They do, however, represent the real needs of a child temporarily backsliding or caught in a cycle of frustration (Ayers, 1972). These requirements can be met with careful consideration subordinate to the larger need for graded challenge and paced alternatives.

- Undemanding equipment must be provided as a relief from too great a challenge.
- Some activities and equipment should provide easily attainable success, requiring little skill or effort.



Repetition of cues and multiple coding of the entry to the Harold E. Jones Child Study Center, Berkeley, California, by Joseph Esherick, Architect. Note the entry defined by the planting, the mat, glass doors giving views inside, even at the smallest of child heights, and direction of the overhead beams. This Center was designed for average children, but has many features which would be excellent for the more acute spatial needs of exceptional children.

Repetition and multiple coding. (Drawing by Tim McGinty.)

Repetition and Multiple Coding

Principle

Cues may have to be repeated several times over to help an exceptional child grasp a message. Multiple coding is the use of several cues (color, shape, texture) to identify an object or space.

Problem and Justification

An important part of child development is what Piaget calls generalizing and reciprocal assimilation, that is, the repetition of familiar patterns of behavior with slightly different objects or parts of the environment. It is through this repetitive activity that the child learns to generalize patterns of behavior to new situations and to reciprocally incorporate two patterns into each other.

The repetition of environmental cues may aid this development and may thus be important to the development of a variety of fine-motor, perceptual, and cognitive skills. Repetition of shapes, colors, textures, designs, and sounds helps maintain the child's interest in learning. It also helps the child achieve generalization, and thus apply newly learned information to other situations. The repetition of activities allows specific skills to develop by the child performing them on a variety of equipment.

Multiple coding is also important to cognitive and perceptual development. Because every element, or group of elements, is coded and explained in a variety of ways, the child's awareness, vocabulary, and mental capacity are expanded. The child learns words and ideas from cues in the outdoor environment in the same way adults learn the metric system by seeing signs on the highway and on food packages.

User Requirements

- Shapes, colors, texture, and design should be repeated in moderately complex ways.
- There should be a planned amount of redundancy, repetition, and reoccurence of space types.
- Many similar objects should be provided.
- A variety of visual, auditory, and tactile stimuli should be provided.
- Explain concepts or provide information about any activity cluster or specific piece of equipment.
- When using numbers, words, colors, textures, shapes, etc., provide as many ways as possible to relate the same idea or meaning.
- Colors and numbers should be used in an integrative way to reinforce what is already inherent in the environment.

Loose Parts

Principle

Loose parts which a child can manipulate in order to shape a personal environment are necessary for cognitive and other developments. They should be dynamic, interchangeable, and manipulable. There are three different types of loose parts: manufactured objects in which the child realizes an invariable finished form (e.g., a puzzle); a manufactured kit of parts in which the finished form is variable (e.g., Tinker Toy); and discarded, natural, and found objects that can be used in any number of interchangeable ways (e.g., tires, boards, sand, gravel).

Problem and Justification

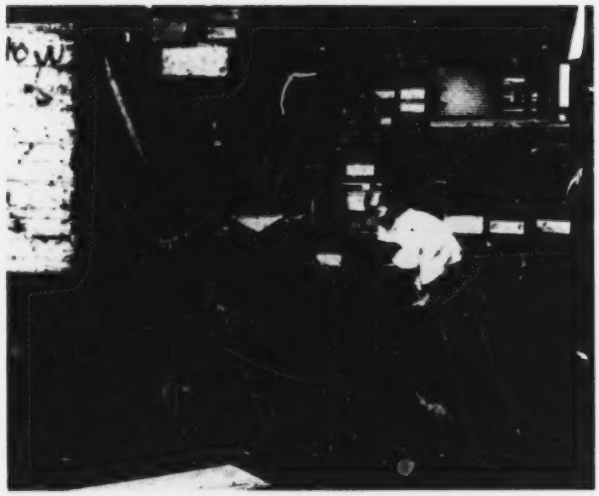
Children need to satisfy their curiosity and to exprience the pleasure derived from discovery and invention. Through "unstructured play," children learn new skills, gain self-confidence, take pride in their achievements, build up a picture of reality, sort out fact from fantasy, and extend their knowledge of the real world.

Children learn spontaneously through active interaction with the environment around them (Piaget & Inhelder, 1969), yet so many designed environments for children are static and rigid. One of the most important parts of growing up is having the opportunity to experiment on the world, to change it, and to see the results of these changes, thus learning from the total experience. Children therefore need to be able to manipulate the environment around them.

Although handicapped children require special care and attention, they too can cope with and gain from a "rough and ready" atmosphere that is different from the usual supervised play environment (Handicapped Adventure Playground Associaton, n.d.). Exceptional children learn new skills and gain self-confidence in much the same ways as average children.

The most articulate statement of the need for manipulable or loose parts in children's environments comes from the British designer, Simon Nicholson (1971):

> "There is evidence that all children love to interact with variables, such as materials and shapes; physical phenomena such as electricity, magnetism, and gravity; media such as gases and fluids; sounds, music, and motion; chemical interactions, cooking, and fire; and other people, animals, plants, words, concepts, and ideas. With all these things all children love to play, experiment, discover and invent, and have fun." (p. 30)



Loose parts at Harbourfront Creative Playground, Toronto, specially designed and built for preschoolers—and even infants. By William Rock, Landscape Architect.

Nicholson's theory of loose parts says, quite simply, the following:

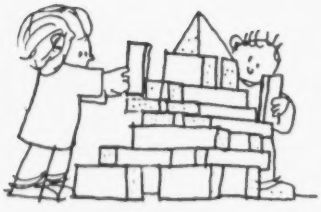
> "In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables in it." (Nicholson, 1971, p. 30)

A range of writers have advocated the value of manipulable or loose parts, including for exceptional children. Lady Allen of Hurtwood (1968), the founder of several adventure playgrounds for physically and mentally handicapped children, suggests that manipulative objects should be provided which demand self-initiated activity. Lehman (1977) advocates offering unlimited opportunities for manipulation. Moran and Kalakian (1974) recommend the provision of at least two manipulative or loose parts areas in school buildings and playgrounds -- one for advanced building systems, and another for other manipulative and tactile experiences. On the basis of his extensive research with exceptional children, Kephart (1960) also recommends that children be able to be aware of what a finished form might look like before actually constructing it.

User Requirements

- Offer opportunities for manipulation
- Provide manipulative objects which demand self-initiated activity (e.g., sand, dirt, etc.)
- Provide the opportunity for the child's awareness of a finished form before constructing it from a kit of parts (may mean

(After Lady Allen, 1968)



The value of loose parts for stimulating children's imagination and creativity, and for giving them a sense of accomplishment and self-worth.

involving children in design and construction)

- Provide space and materials to build undetermined structures
- Provide manipulative and tactile experiences separate from the more advanced building areas
- Include provisions for storage, activity space, and tools for children's use with found objects such as tires, boards, bricks, etc.
- Provide exceptional children with manufactured sets of loose parts such as giant Tinker Toys, outdoor modular blocks, etc.
- Zone high activity loose parts areas (e.g., adventure play areas for handicapped children) away from less-intensive loose parts areas (e.g., Tinker-Toy style creative play areas) and from quieter retreat and observational areas.

Ambiguous to Defined Settings

Principle

Environments for exceptional children should range in spatial definition from ambiguous spaces to some highly defined settings. Defined settings like playhouses, mock garages, stores, and bridges allow for planned fantasy games and role-modeling behavior. Ambiguous settings and objects, like rocks, wood, and sand allow the children to use their own imagination.

Problem and Justification

Children expand their experiences of the world and people in it by creating "mind-dramas" with settings, characters, and plots which incorporate familiar and unfamiliar elements. Fantasy play, dramatic play, role-playing, imitation, and creative expression are all important activities for young children. By role-playing, children can understand others better and increase social skills. By imagining unfamiliar places and things, children explore their environment widely. According to Claire Cherry (1976):

> "Dramatic play offers children safe ways to explore their awareness of their own growing abilities and changing roles in their relationship to others . . . a means of expressing anti-social ideas and impulses . . . [and] responding to their ongoing need for creative expression."

Considerable research in the child-environment field indicates that ambiguous settings and objects are necessary for this creative, imaginative, and self-initiated activity. Garvey (1977), for example, shows that objects or props for dramatic play can be very ambiguous as children do not need literal props to stimulate imagination. In fact, props which are too specific and static (e.g., a metal rocketship) will limit the inventiveness of children (Stone, 1970). Research conducted by Gary Moore in Australia supports these findings. It was found that children in outdoor play settings indulge in two types of fantasy play: informal or spontaneous fantasy which appears to be stimulated by the characteristics of the immediate physical environment (e.g., an unstructured sequence of fantasies evolving from a ditch to become an animal chasing game and then a jungle game as vertical obstacles are encountered); and more structured or planned fantasy games which can happen anywhere (e.g., a group playing hospital or house). Further, this research showed that fantasy play is a very fragile thing, the fabric of which can be shredded by the presence of an adult observer (see Moore & Rose, 1976).

In ambiguous settings, an undefined structure can become anything a child wishes, from a castle to a car, and the child can generalize play and create personal settings or social roles. Defined spaces such as playhouses, garages, stores, and so on evoke more specific responses from a child. This modelling behavior is especially important for the exceptional child, who is often over-protected and sheltered from real-world transactions.*

Ambiguous settings, therefore, relate more specifically to imagination, emotional development, and representation abilities. More defined settings relate to role-playing, personality development, and social interaction.

User Requirements

- Provide ambiguous, undefined settings and structures for children's imaginative and creative play.
- Provide adaptable "stage set" play settings which can be transformed easily by the child or teacher into a house, a school, castle, bridge, theater, etc., for role playing and modelling behavior.
- Within settings, provide elements and details that contribute to specific modelling behavior, e.g., in a store provide shelves, boxes, cans, cash register, etc.
- Provide several "private stages" sheltered from adult eyes and without an audience to spoil concentration and imagination (e.g., behind bushes, under low platforms, up or down levels, etc.).
- Provide an area for informal audiences to watch a formal dramatic play.
- Provide props and architectural elements that are ambiguous and able to become many things to many children.
- Provide some building materials similar to big Lego Blocks or Lincoln Logs.
- Provide some more defined equipment used in role-playing and pretending, e.g., telescopes, walkie-talkies, costumes, music, role hats like fireman's hats, artists' sun visors, etc.
- Provide storage for props, building materials, equipment, and costumes which can be locked and protected from moisture if outside, but which are also easily reached by handicapped children and visually accessible to visually impaired children when unlocked.

* From a staff interview at the St. Francis Children's Center, Milwaukee, October 1976.

Orderliness and Consistency

Principle

The built environment should be orderly and consistent so that it does not confuse any exceptional children who have learning or perceptual difficulties.

Problem and Justification

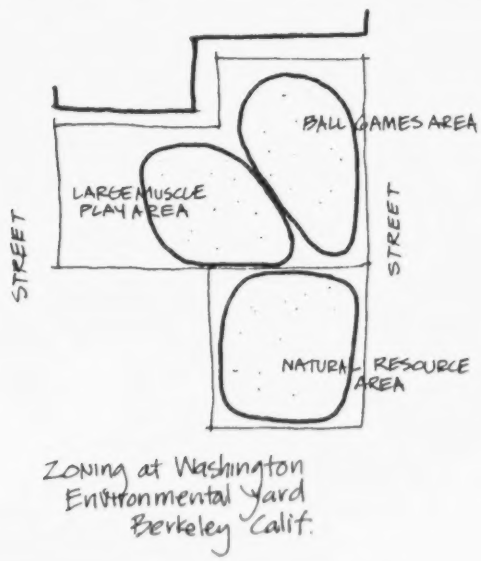
Exceptional children are sometimes confused and even thrown into a hyperactive state by environments that are unnecessarily ambiguous, contradictory, and complicated. For example, many exceptional children have some sort of perceptual difficulty. When exposed to irrelevant stimuli, they may react hyperactively (Cruickshank, 1977).

Orderliness and consistency in the environment may reduce perceptual ambiguity, irrelevant stimuli, and hyperactivity, and thus may increase the conduciveness of the environment for the entire learning process. Predictability and a certain amount of simplicity may reduce the sensory-based hyperactivity and inner anxiety so common in the experience of the exceptional child (Ayers, 1972).

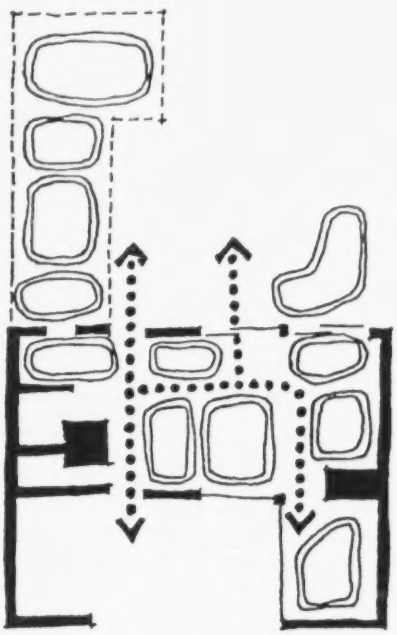
Although novelty, complexity, and dissonance are stimulating properties of the environment for children (Sutton-Smith, 1972), these qualities must be balanced with the unusual needs and limitations of special children. Applying this principle to exceptional children suggests that the environment should be subdued, but the designer must not take this too literally and leave out variety and interest in the surroundings and equipment. The reason for orderliness in the lives of such children is to avoid the over stimulation and disorientation that easily affects them. There is a fine line to be drawn, however, between chaos and boredom.

User Requirements

- Activity areas should be simple and have a limited number of pieces of equipment.
- Irrelevant stimuli should be eliminated; this will help control children who are prone to sensory hyperactivity.
- To aid in way finding and orientation, the environment should be straightforward and unambiguous.
- Places of sudden movements and noises should be shielded from other places where children are expected to be involved in quieter pursuits.
- As children are not stimulated by environments which are monotonous or boring, the needs for orderliness and consistency must be balanced with the needs for novelty, complexity, and excitement.



Orderly zoning of an outdoor play environment. The Washington Environmental Yard, Berkeley, California, by Robin Moore and Herb Wong. (Drawings by Frederick A. Jules.)



An orderly and consistent interior space for preschool children. Clear activity areas, and clear circulation which overlooks the activities. Harold E. Jones Child Study Center, University of California, Berkeley, by Joseph Esherick and Associates, Architects.

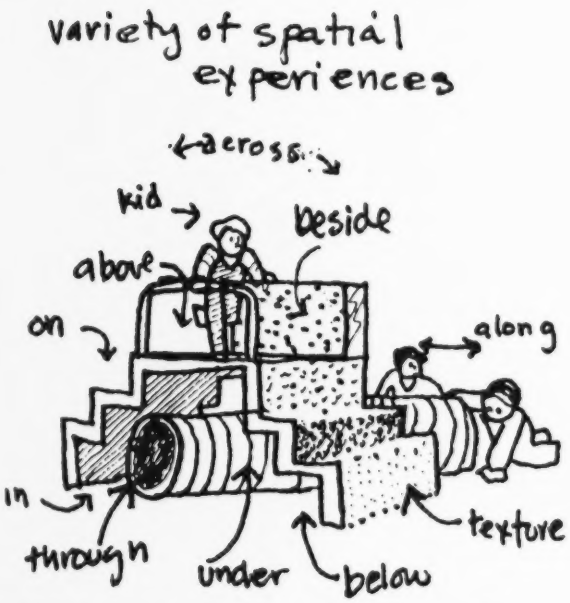
Variety of 3-Dimensional Spaces

Principle

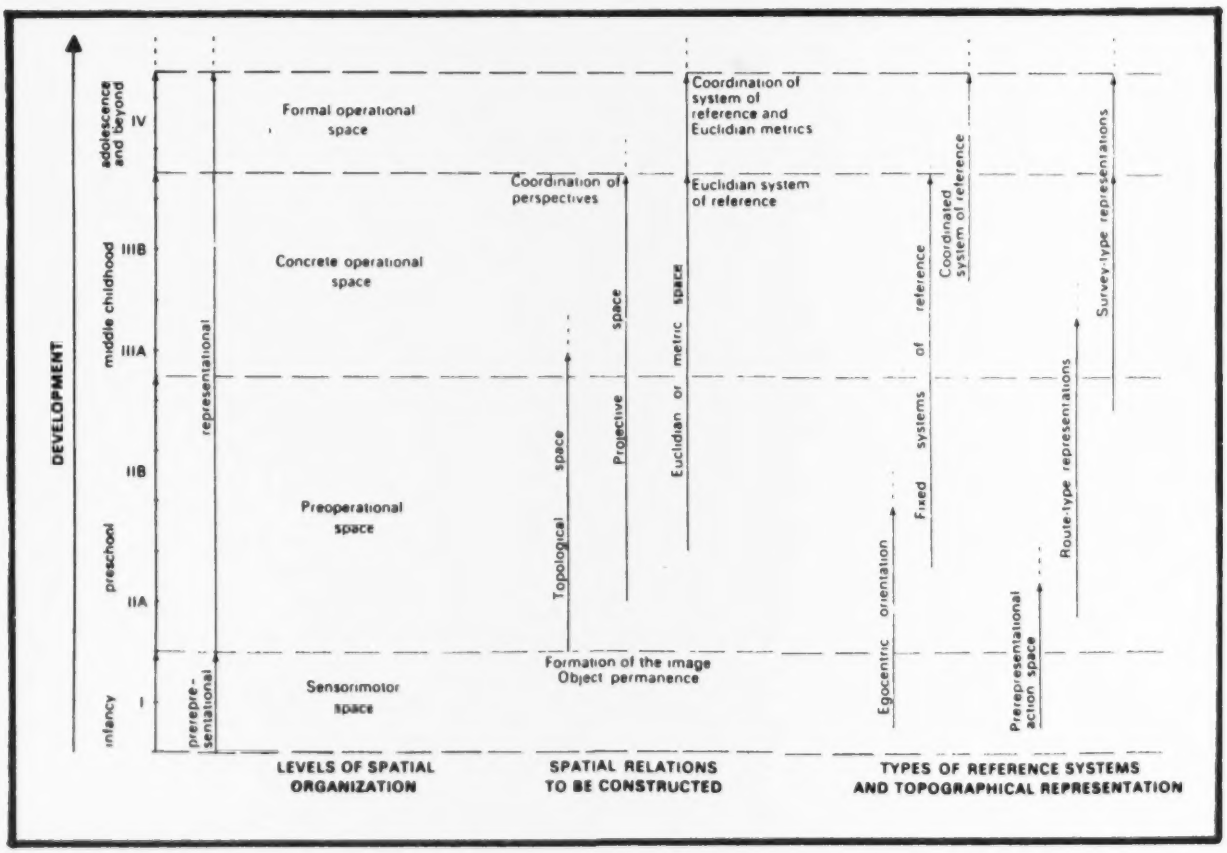
To assist in the awareness of space and in stimulating perceptual and motor development, children should be able to experience a variety of spaces through different sensorimotor and locomotor activities. Being in and moving through different types of spaces provides a rich variety of spatial experiences.

Problem and Justification

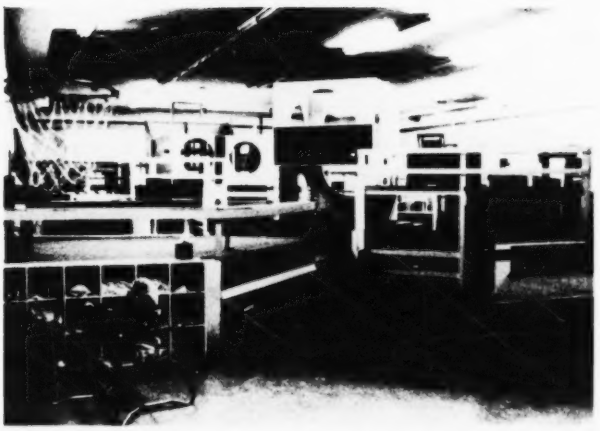
In order to relate to large and small environments, a child must become aware of space and learn spatial concepts such as over/under and in/out through various locomotor activities. Early development of the perception of depth, for example, depends on texture and shadow (Bower, 1965; Pick & Pick, 1970) which therefore are important in all children's environments. The development of directionality, based on laterality, is dependent on the kinesthetic experiences of moving the body through a variety of



Variety of 3-dimensional spaces. (Drawing by Tim McGinty.)



The principle stages of the development of spatial and environmental cognition. (Reprinted from Hart and Moore, 1973.)



A variety of 3-dimensional spaces created by an infill series of platforms. Satalite Americana Preschool for Early Learning, Washington, D.C. by Paul Curtis and Roger Smith, Architects.

three-dimensional spaces (Kephart, 1960). To become cognizant of more complex spatial environments -- like buildings, neighborhoods, and cities -- the child must become aware of spatial relations such as the topological, projective, and euclidian concepts of open/closed, left/right, near/far, and precise physical distances (Hart & Moore, 1973). Developmentally a child organizes spatial relations around egocentric references (the child's position in space), fixed references (familiar places), and abstract reference systems (geometric and cardinal references) as they develop through the three principle stages of environmental cognition (Moore, 1976b).

To assist the child in these important cognitive developments, two things are necessary: first, the opportunity for a range of spatial experiences; and second, specific environmental stimulation. The opportunity for falling, a sometimes fearsome, frustrating, and humiliating activity, is an important example of the kinds of experiences so vital to the development of spatial awareness and subsequent continued development of various motor developments (Handicapped Adventure Playground Associations, n.d.).

To directly stimulate the child, the environment -- both indoors and outdoors -- can be structured to motivate exploration and movement through a series of developmental stages. Examples include the provision of a variety of spaces having the following properties: on, beside, behind, over, in, along, under, before, between, through, against, around, across, by, from, toward, above, below, and so on, organized in terms of topological, projective, and Euclidean progressions. Other examples include the provisions of texture gradients, shadow patterns, other visual perceptual cues (see Hesselgren, 1975; Prak, 1977), a variety of fixed reference points and clearly articulated alternative abstract reference systems (see Hart & Moore, 1973; Moore, 1976b).

User Requirements

- All environmental scales should provide for a variety of spatial experiences.
- High places, knolls, and towers with views of activity should be provided.
- Some crawling should be required in many different places.
- There should be things such as tunnels, different sized boxes, cubes, and squares.
- Depth cues such as texture, shadows, and others should be included in all portions of the environment.
- Opportunities should be provided to fall safely.
- A variety of locomotion experiences (up/down, under/over, etc.) should be provided for infants and older children, and should be organized to present a full range of topological, projective, and euclidian concepts to the child directly through his or her experience.
- A variety of fixed reference points and alternative clearly articulated abstract reference systems should be provided in the child's environment to aid in the development of an overall cognitive map of the environment.

Clear Accomplishment Points

Principle

Success must be made obvious to children with special problems since they have difficulty in recognizing that they have succeeded at an endeavor. Environments should incorporate recognizable stages of performance, clear points of completion, and possibilities of display of accomplishment to peers and staff.

Problem and Justification

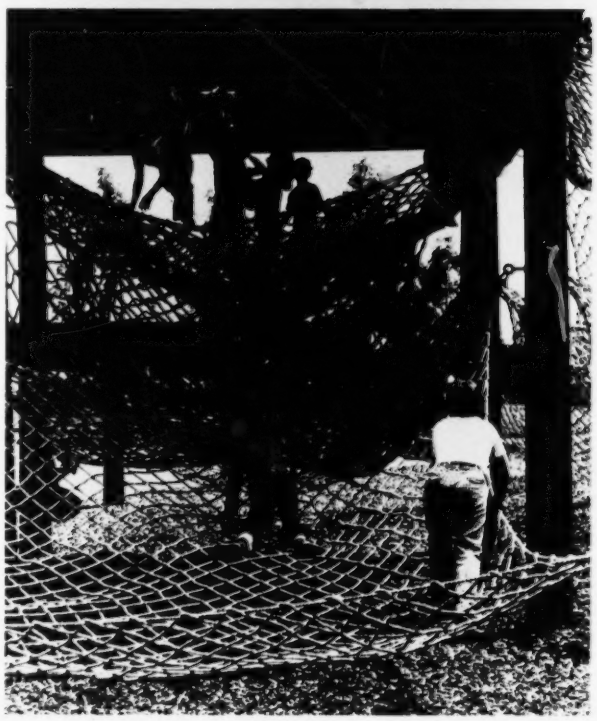
Children are constantly being confronted with all the things they don't yet know and can't yet do, and this is especially true for the exceptional child. The special child's frustration only breeds failure (as any teacher of a fourth-grade non-reader will tell you). Success, on the other hand, gives children positive feelings about themselves and their ability to continue to develop and eventually to "grow up." Public display of this success can only further reinforce these positive feelings.

Success in an activity, therefore, is fundamental to progress and learning. Realization of this success or accomplishment is both a reward and a reinforcement for desired behavior. Public realization of this success further strengthens the child's self-concept and promotes self-confidence, both goals of personality and social development.

Environments which combine challenge and success scaled to exceptional children's capabilities can be rewarding to children (Ayers, 1972).

User Requirements

- Provide opportunities for the fulfillment which comes from the right combination of challenge and success.
- Provide environments which combine challenge and success scaled to children's capabilities.
- Provide opportunities for mentally retarded or emotionally disturbed children to have adequate play experience, with frequent opportunities for successful achievement of play skills.



Clear accomplishment points. Landscape design at Peacocks Point Park, Balmain, Australia; and a climbing play structure at Children's Village, Toronto, by Eric Macmillan, Designer.

Retreat and Breakaway Points

Principle

Retreats must be provided for individuals or groups to be away from the rest of the group. Provision must also be made for a child to leave before completing an activity without feeling as a failure.

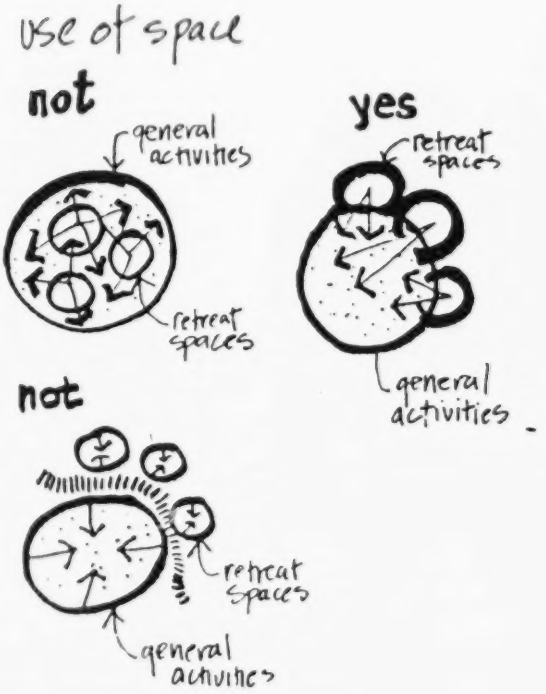
Problem and Justification

The provision of retreat areas is crucial to the development of self-concept and personal identity. When children are alone they have come to terms with self, how the "I" relates to a tree, space or the self. Being alone is more conducive to imagination, adding hypothetical activity and meaning to a simpler situation. In opposition to retreat is the need for children to learn their role in society, but a child must sometimes retreat to solitude when confused or overwhelmed by society. Good breakaway points encourage greater exploration by providing face-saving exits from unfavorable situations.

Observational learning from watching other children's activities is also an important part of development. Studies in Great Britain have found that the number of children observing play is equal to or greater than the number actively playing (Hole, 1966; Department of the Environment, 1973) and this has been confirmed in the United States (Cooper, 1975). Evidence from some of our own research indicates that observing behavior is often the single largest type of children's behavior in neighborhood outdoor settings, e.g., accounting for 21% of all observed behavior (Moore, Burger, & Katz, 1979).

User Requirements

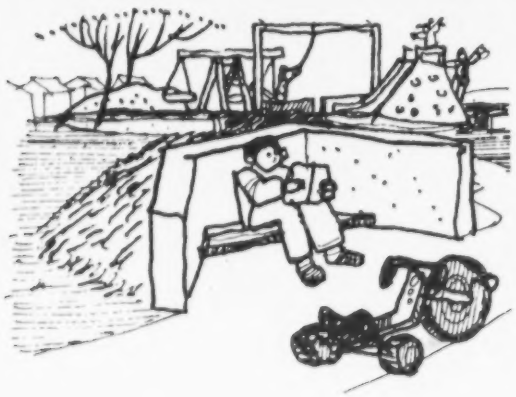
- Settings should provide the opportunity to gain and maintain personal privacy.
- Places should provide the occasion for a child to withdraw into a sheltered world.
- Private places which are connected to larger activity areas should enable a child to get away from the group.
- Opportunities should exist for groups of children to have seclusion and quiet.
- Natural, unobtrusive observation points should be provided for children which are child-scaled and which overlook other activity areas, e.g., small treehouses, tower platforms, crows nests, raised catwalks, level changes with natural barriers.
- All parts of the built environment should have opportunities and places for children to break away if the activity becomes a strenuous, demanding, anxiety producing, etc. A ladder, for example, might have access to two platforms before reaching the top level, thus permitting children to stop at any stage while they are gradually overcoming fears of height and gaining climbing abilities.



Retreat spaces as nooks off general activities.

Both quiet areas and areas for emotional "explosion" are necessary.

A lookout—a place to watch the action for a while from a safe vantage point. The first author's daughter, Mindan Gunther-Moore, in Toronto.



Retreat and breakaway points. (Drawing by Tim McGinty.)

Running through foam-rubber dummies at Children's Village, Toronto.

Emotional Release Areas

Principle

Children require settings or activities that allow them to express and release emotional anxieties, such as anger, tension, or frustration with themselves, others, or the environment.

Problem and Justification

Children can become frustrated by their inability to function mentally or physically, e.g., their inability to climb a ladder, to communicate successfully with others, or to cope with sensory overload.

For some children, the simple joy of free play outdoors or walking through a garden will help them get away and ease their frustrations. Other children need to be coaxed into relaxing or becoming active to help them forget their troubles. When children have trouble coping with the environment, they need an area in which they can express their emotions and release their tensions and aggressions.

Children can be coaxed passively with music or color in the environment (Cratty, 1969; Grey, 1969), or they can get frustrations out of their systems by acting out a role. On the more active side, they can release pent up emotions by having things to build, knock down, throw, or kick (Allen, 1968), and places to run, fall, jump, and let off steam safely (Abeson & Blacklow, 1971) or even to kick and punch away any violent aggressions (Cherry, 1976).

The release of tension and frustration is most crucial to emotional development. Social development follows as the child becomes mentally stronger in dealing with communication and emotional expression, and in dealing with physical handicaps. Motor development becomes an indirect achievement. Even though this is not the main objective, gross-motor development takes place in the activities suggested for emotional release areas.

User Requirements

- Provide areas where children can safely let loose
- Provide mood-setting music
- Provide active and passive color schemes: earthy reds and ochres are conducive to high activity; yellows are bright and cheery
- Provide secluded areas sheltered from sensory overload (Note: some children also need to see others playing, in order to let loose themselves.)
- Provide nature walks
- Provide areas for role-playing
- Provide areas with loose parts so children can become involved in building up, tearing down, and starting all over again
- Provide soft areas where children can kick and punch away any violent aggressions.

Challenging Environments Without Undue Risks

Principle

The design of indoor and outdoor play/learning centers must balance safety and supervision against challenge and freedom. Major safety factors include zoning of physically active from quiet and passive activities, soft surfaces, and safe equipment.

Problem and Justification

Children need all types of challenges but safety is a major concern of parents and administrators.

Playgrounds in the past have been a source of numerous accidents (Sweeney, 1977). Hard seats of swings that can hit heads, free-standing slides that children can run into or fall off, hard surfaces under equipment -- all are dangerous elements. The underlying reasons for most accidents appear not to be equipment failures but two planning issues: (1) unwise zoning of activities within the play space permitting children who are actively doing one thing to run into other smaller or quieter children; and (2) unwise siting which forces young or exceptional children to cross busy streets to reach day care centers or play areas (Wilkerson, 1978).

At first glance, the newer creative and adventure playgrounds may seem to be much more dangerous than the older metal equipment and asphalt type. But preliminary data contradict this assumption. As dangerous as they may look to the uninitiated, and though precise data are still somewhat scarce, adventure playgrounds appear to have fewer serious accidents than traditional playgrounds (Vance, 1978).

Certain safety features can be introduced into other types of play areas. The best surfaces are soft and pliable, like natural ground cover, wood chips, and sand (Allen, 1968; Bengtsson, 1970; Utzinger, 1970; Sweeney, 1977). Dangers due to equipment can be eliminated by proper placements and sizing of elements for anthropometric fit.

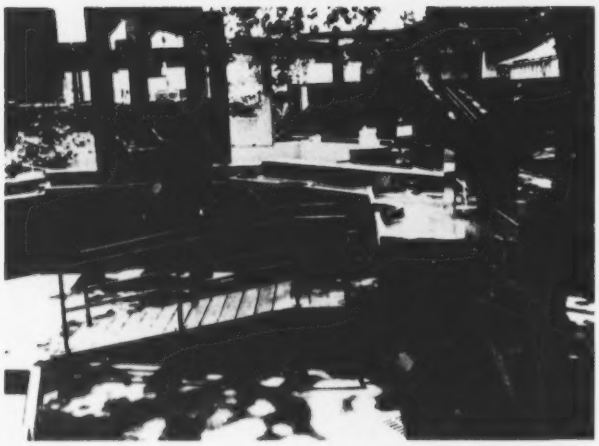
However, the environment must not be so safe that children cannot fail. When any child -- including an exceptional child -- has occasional difficulty with an activity (e.g., falling off a balance beam), he or she can learn more about the nature of that activity (Kephart, 1960). The playground offers an ideal environment in which young children can experience elements of risk and challenge. The real needs of children -- including the need to test and extend their abilities through risk-taking -- can be met successfully in a well-planned play area without compromising a high degree of safety (Seitzky, 1975).

A challenging climb for this infant, without undue risk, Central Park, New York.

One way of allowing slightly more challenging environments is to provide tighter surveillance over highly active or potentially dangerous activities. Close supervision of children in and around equipment, construction activities, and large-motor activity areas is especially vital. In general, to encourage challenges, the child should feel secure and the adult supervisor should not have to feel anxious over the child's safety.

User Requirements

- Any activity at a child's skill level should not be inherently dangerous.
- The supervising staff must be able to see all equipment in an area they are responsible for.
- Equipment should be both accessible and usable by the supervisiong adults.
- Handrails and handholds are to be used where needed.
- Soft surfaces should be used to cushion hard falls.
- The anthropometrics of users are to be considered in all designs.
- There should be space on all equipment to change position or to adjust oneself to use the equipment before completing the activity.



Two qualities of a barrier-free environment: children may stand or be in wheelchairs at this stepped series of water tables, and ramps provide access for the very seriously disabled. Jesse Stanton Developmental Playground, New York, by Richard Dattner, Architect.

Barrier-Free Environment

Principle

All environments for exceptional children should be accessible to the physically handicapped.

Problem and Justification

Since physically handicapped children have the same social, cognitive, and even physical needs as other exceptional children, it is obvious that their play and learning needs are also similar. Barring them from play spaces, schools, preschools, or day care centers by creating -- or not eliminating -- barriers in access, circulation, and equipment amounts to hindering their development beyond the problems the particular physical handicap may imply.

Children who have a handicap must therefore be allowed and encouraged to develop as normally as possible, and to do this they must have access to the same play and learning settings as other children. Research has shown (see Alexander, Ishikawa, & Silverstein, 1977) that a child's peer group may be even more important than parents to healthy emotional development, and this is especially true for handicapped children.

It seems important, therefore, to minimize barriers while expanding activities in which all children can participate -- average, able-bodied, physically handicapped, and other exceptional children.

User Requirements

- While considering specific activity spaces, use A Playground for All Children (U.S. Department of Housing and Urban Development, 1978), and ANSI 117.A, Specifications for Making Buildings More Accessible to and Usable by the Physically Handicapped (American National Standards Institute, Steinfeld, 1978) to add experience which would enhance this type of activity for handicapped children. For example, loose parts may be made especially rich in tactile and auditory experiences for blind children.
- Use ramps instead of, or in conjunction with, steps for children in wheelchairs or with braces, crutches, etc.
- All steps, curbs, walkways, doors, toilets, drinking fountains, etc., must be carefully considered for their accessibility.
- Wheelchair access to hills should be made easier with nonskid surfaces and down-slope stop curbs.
- A child should be able to sit under an overhang and play with his or her arms resting in sand and water.
- Surfaces should be hard enough for wheelchairs, yet safe and nonabrasive. Use a material such as composite rubber and acrylic or 3/8"-thick "Elastaturf" on concrete.
- Youngsters with braces, crutches, or in wheelchairs cannot open back-up doors. Therefore, incorporate "tambout" type doors which fold into recessed areas of the wall.
- Children should be able to easily move from the outdoor play area to transportation pick-up points.
- A berm, fence, or sign must be no higher than 48 inches if an adult in a wheelchair is to see over it. The height is reduced accordingly for children.
- Trails should be of a continuing common surface; steps and abrupt changes are to be avoided; trails should be 5'-0" wide to allow wheelchairs to pass; and gradients should not exceed 5%.
- Ramps must not have a slope greater than 1'-0" of rise in 12'-0" of run, and should be a nonskid surface; width should be 4'-0" at least; all ramps must have handrails on each side to fit children's arm reach, about 16" to 24" above the ramp. When appropriate two parallel handrails at different heights could be used.
- All stairs should have rounded nosing; riser 5-3/4" and tread 14"; handrails should be as described above.
- Rest areas should be provided especially where the gradient is greater than recommended.
- Water fountains should have water spouts up front and foot and hand-operated controls.
- Doors should be between 3' and 4' wide; thresholds should be flush with the floor.

- Indoor and outdoor seating furniture should have back and arm rests; the seat's depth and height should fit the specific proportions of the primary age group of the users; picnic and other tables should have separate stool seats of various heights and distances from the table for those wearing braces, which also allows wheelchairs a closer approach; the bottom of the table should be 30" above the ground for wheelchair users, or as appropriate for other seating or standing postures.
- A fire pit with fire rings raised 24" from the ground provides a campfire usable and safe to everyone.
- Open field space should be free of potholes and ruts; it should be a flat, usable space.
- Provide a slide and allow for a crawling area to reach a slide, or provide a ramp with 8% maximum grade to reach the top, and a 5' x 5' level platform on the top.
- A box-type swing or a tire swing is good for severely disabled children.
- The top of a sandbox should be at the same level as the ground to reduce obstacles; water or sand tables should be raised 30" above the ground for wheelchairs.
- Provide nature areas with dwarf trees that allow children to smell flowers or pick fruit; provide simple pathways and raised planting beds.
- Provide some soft surfaces which children who can't walk could crawl or roll on.
- Use signage with raised letters at a height children can reach.

Children with perceptual, learning, or physical handicaps deserve unbridled access to all parts of the play environment—indoors or out.

Section 3
Case Study: The St. Francis Children's Center Outdoor Play/Learning Environment

This entire endeavor of generating a developmentally- and behaviorally-based program for children with exceptional needs originated from a specific request by the St. Francis Children's Activity and Achievement Center in Milwaukee for an outdoor learning environment for their children. It is fitting that at this time, having discussed the process and design guide that evolved, we return to the case in point to illustrate the application of developmentally-based design principles to a specific design project.

This section will describe the St. Francis Children's Center, the facility, the program, and its people. Then, following our process of applying design principles and utilizing participatory sessions, the various stages of the design will be shown and discussed with suggestions on application of the design principles to other contexts and situations.

The Context: The St. Francis Children's Center

The overriding goal of the St. Francis Center is to help each child become an independent and fulfilled person, eventually able to function in the mainstream of society. The program and facilities are designed to provide each child with the particular training appropriate to his or her individual needs, learning mode, and developmental stage.

No labels, such as "trainable mentally retarded" or "educable mentally retarded," common to similar schools, are used. The staff feels such categorization prevents seeing the child as a unique person who can learn if appropriate methods can be found.

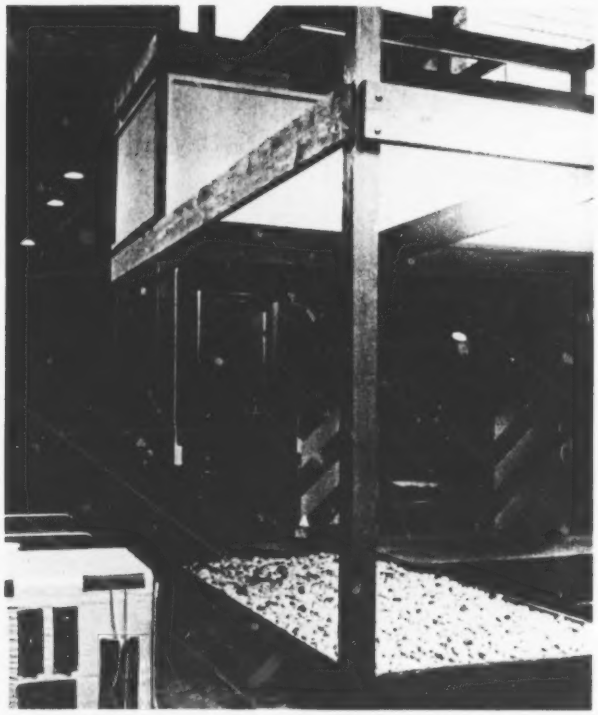
Children are referred to the Center by physicians or teachers. Fees are assessed according to the ability to pay, with the provision that parents become active participants in their children's education, both at the Center in parent-training sessions and volunteer work, and at home in following through on the program.

Between 80 and 100 children attend the center as day or half-day students. They range in age from infancy to 12 years. Another 50 older children attend after-school and Saturday programs in the building. The core day programs are serviced by 50 full-time staff members plus administrators, volunteers, student teachers, and part-time professionals, such as a psychiatrist and social worker for family counseling.

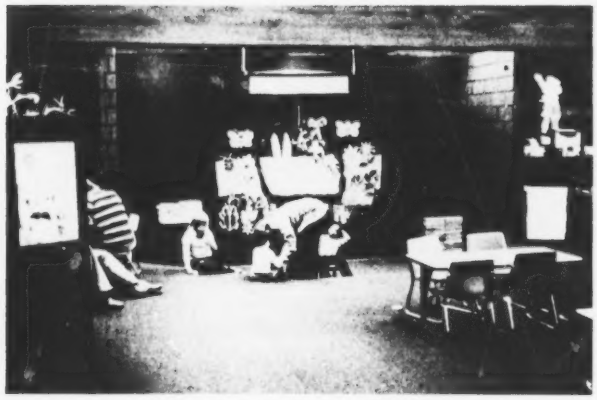
The Facility

Built in clustered sections to break up space into residential scale volumes, or "pods," the architecture of the Center has a warm non-insti-

The St. Francis Children's Activity and Achievement Center, Milwaukee, by Brust-Zimmerman, Architects. Designed for a 4.3 acre site, the original building cost $1.3 million. The proposed outdoor play/learn extension would cover 1.5 acres and would cost c. $200,000.



The central core is taken up with a Self-Initiated Learning Center (SILC) which is an indoor play/learn environment comprised of different textures, spaces, heights, climbing devices, colors, and sounds.



Learning pods are carpeted, have a number of nooks and crannies, and are designed to be broken-up into semi-private areas where teachers and children can work together.

tutional atmosphere. Groundfaced concrete block and wood beam construction inside and out blend with wood decking, glass, carpeting, and vibrant supergraphics which easily identify different areas of the building for non-reading and perceptually handicapped children.

In the transverse defined by the three pods is a Self-Initiated Learning Center (SILC), a depressed multi-level playscape with a slide, water bed, bridges, gravel beds, and raised play houses with various textures, colors, and moveable wall panels. The SILC is used for supervised independent play as a reward for completed learning tasks.

The Program

With the goal of eventually mainstreaming each child into a standard school situation, the day's basic structure roughly approximates traditional school procedures. The class gathers as a group in the morning for songs and discussion of the day's events. Classmates are together for an outdoor play period, lunch, rest time, and a story at the end of the day. But within that somewhat standard structure, each child has a unique program which responds to his or her individual requirements.

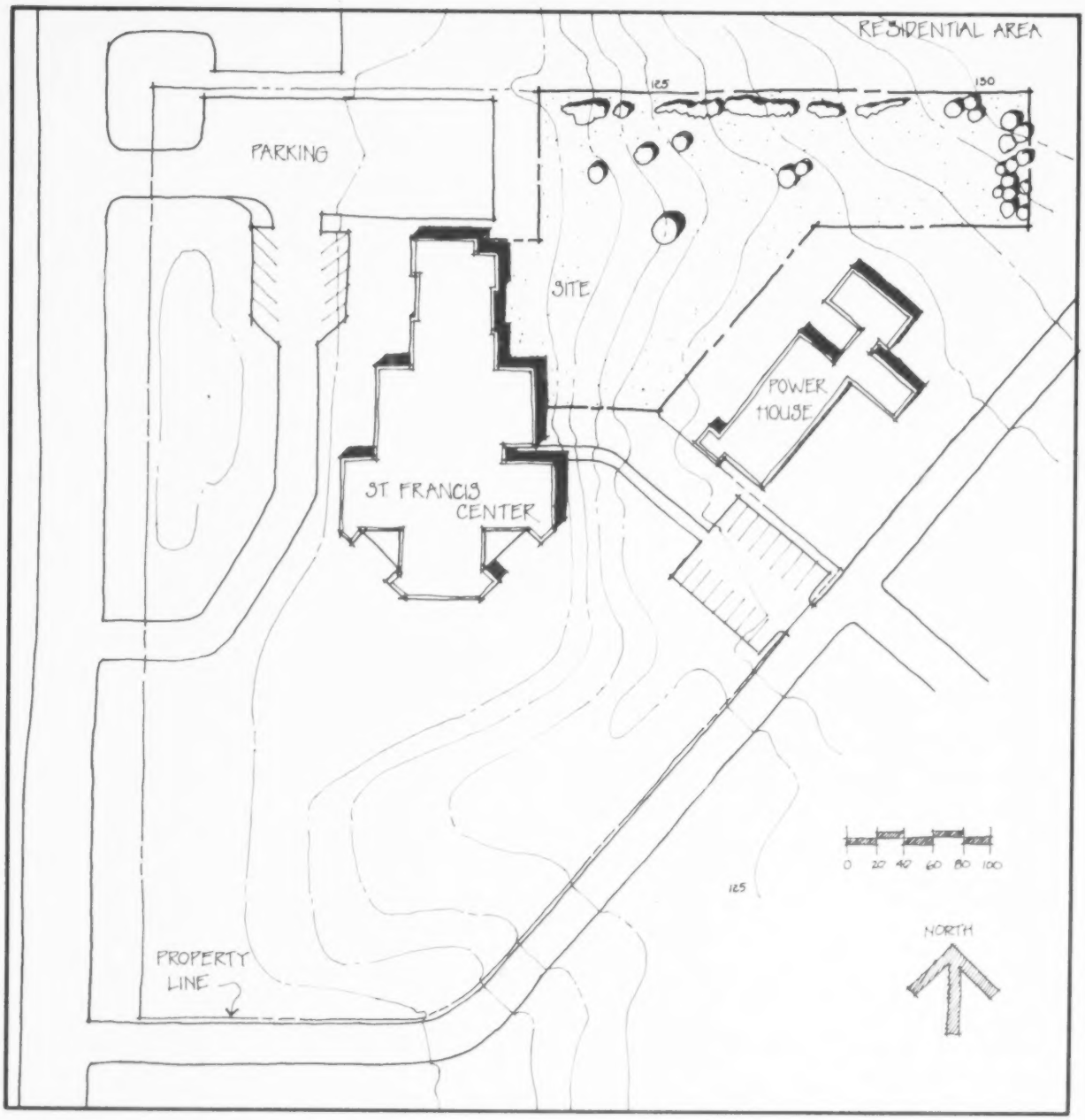
Through extensive evaluations, each child's needs are detailed and continually reassessed. With an approximate child-to-teacher ratio of one-to-one, an individualized program of instruction is charted for each child in joint staff meetings. The day is blocked into time slots providing flexible scheduling for special needs.

Within the classroom area, teachers work with children individually or, when possible, in small groups on various academic and basic skills. Special teachers pick up children from their classroom for speech and language therapy,

motor skills training, specific evaluation, or supervised play in the SILC.

Parent volunteers and student teachers provide support services in helping children from one area of instruction to another and in supervising activities. Though the school day is basically the same length as a standard school, the complexity of individualized schedules and coordination of staff requires many hours of meetings, evaluations, and record keeping. Staff lounges and conference rooms are heavily used for planning and scheduling.

Though the heart of the architectural program for the outdoor play/learning environment was generated by eliciting and articulating the Center's developmental goals for the children's



Plan of the existing St. Francis Children's Center site.

outdoor activities (which lead in part to the above generic goals and principles), a number of additional issues rounded out the specific program for the site.

Generally, the Center wished to complement the indoor, highly structure program with an outdoor, less-structured series of activity possibilities. Thus the outdoor area was to be designed as a special activity, learning, play, and recreation area that would meet their children's special developmental needs. Children's spontaneous play activities were to be anticipated and appropriate environments designed.

Additional concerns were expressed, among them the needs of the after-school children and weekend children and retarded adults who use the Center. The needs of infants as well as preschool and school-age children were included. Safety, durability, and maintenance concerns were expressed.

Finally, the administration and staff made a big point about wanting a range of interesting and challenging environments, including small intimate spaces, open playing fields, manipulable elements, natural environments, a contemporary and clean image, and a sharp transistion between indoor and outdoor space. All of these issues became important design considerations in interpreting and applying the generic design guide of Section 2 to this particular context and site.

Site Analysis

Potentials and restrictions of the site as an outdoor learning environment, as well as its inherent physical characteristics that might bear on design decisions were analyzed.

The site analysis was divided into three main categories. The first dealt with the site in relationship to its immediate surroundings. This included a neighborhood analysis and observation of the site in conjunction with its built surroundings. Noise penetration, potential views, and location of existing utility lines and other built items were considered.

The second category concentrated on the physical and natural environmental characteristics inherent to the site. They included existing vegetation, predominant climatic influences, soil analysis, hydrological study, and a geographical and topographical survey.

The third category was a legal analysis of the site and immediate area to determine zoning restrictions, local building codes, and state codes for design for the physically handicapped.

Preliminary Design

To interpret and apply the generic design guide, it was found initially useful to apply two or three principles at a time, not the entire set. In fact, the first sketch designs were developed without considering the specific site constraints. As design ideas arose which seemed to fit the principles, they were modified to fit the constraints of the site, and were combined with other partial solutions to create more integrative, synthetic designs.

This was found to be a very powerful and useful strategy for two reasons: (1) it provided a way to grapple with portions of the guide and program, and yet to integrate the whole; and (2) it insured that the design ideas would be first and foremost responses to the most important objectives -- the children and their needs as articulated in the series of design principles and supporting developmental goals. Our experience is that this latter point is absolutely essential for the creation of a new, behaviorally-based architecture.

Thus, the overall design phase of the project was divided into three sub-phases: (1) a preliminary design phase in which alternative design site-independent ideas were proposed in response to portions of the developmental information; (2) a schematic design phase which was site-specific and responded to more of the program; and (3) the final design phase in which an integrated, detailed design solution was advanced.

A one week sketch design problem was launched in which each member of the design team became familiar with the design guide by coming up with a preliminary design proposal that spoke to at least a portion of that information. Each designer selected a set of goals and principles and proposed design ideas which were not site-specific. Three examples are shown.

Continuity and Branching was an important principle used in formulating one schematic design (see accompanying illustration). Clear Accomplishment Points also influenced this early design. A series of towers is linked by various climbing, bouncing, and jumping apparatus. One route, as illustrated, takes a child from a tower to a rope ladder to an air mattress down a slide, and so on. Each tower, or pod, leads to other towers or activities and acts like a trunk of a tree, with branches leading to other branches which in turn lead back to a different trunk.

In the second sketch design, a greater variety, complexity, and scale of apparatus can be seen. This second, slightly more refined sketch design was in response to the above, but was also influenced by Paced Alternatives and Variety of

3-Dimensional Spaces. A rudimentary design response to Multiple Coding can also be seen in the window details. From the central pod, or tower, extend ramps, slides, and ladders with various characteristics that lead to grass areas, hard surfaces, air mattresses, and other pods. A number of different spaces are beginning to be incorporated -- they vary in terms of size, shape, opening, different means of access and egress, some above, some below, some the child goes up to, some he or she goes down to, different views out, and so on. Places for Retreat (though not Breakaway) can also be seen in this proposal. This preliminary proposal is also interesting in that a number of developmental goals not directly translated into design principles have also influenced it, among them numerous possibilities for gross-motor development, opportunities for role playing, and spaces for social games.

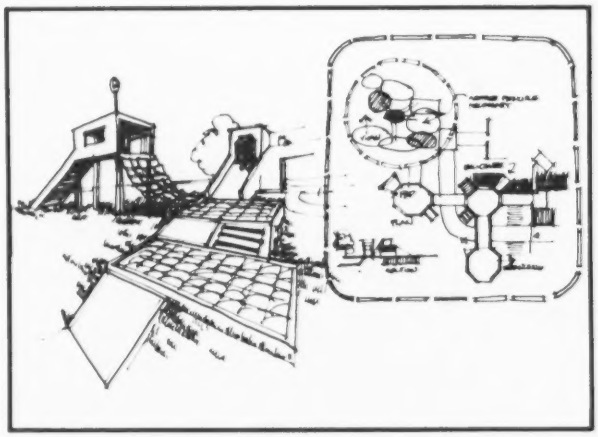
The third preliminary sketch is an example which both responds to a wider range of developmentally-based design issues and responds to more of the site constraints. It begins to be site-specific, fitting to the gradual slope to the land at the St. Francis Center running downward from east to west (upper right to lower left). Spaces within the pods range in size and transparency, and are reached in a variety of ways. Continuity and Branching, Paced Alternatives, Variety of 3-Dimensional Spaces, Clear Accomplishment Points, and Orderliness and Consistency are clearly seen in this solution, as are the rudiments of Repetition (though not yet Multiple Coding) Ambiguous to Defined Settings, and Range of Social Scale. Even loose parts are beginning to make their way into the background.

Participatory Design

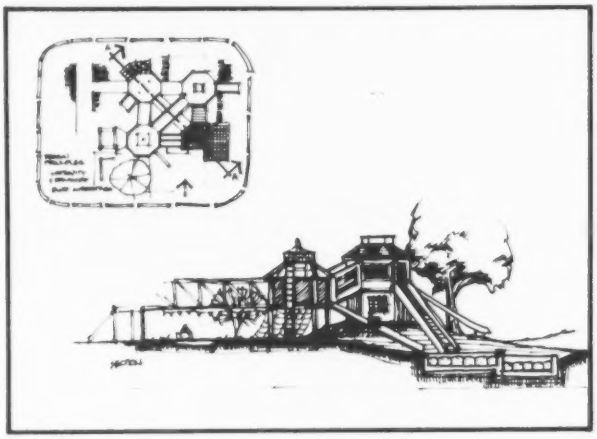
These preliminary sketches were presented to the St. Francis Center administration and staff at a review session and proved to be helpful in stimulating the participatory process within the joint groups. Formalizing the work up to this point into concrete solutions enabled the staff to react to the design and led to a number of alternatives, suggestions, and insights. We were also able at this time to uncover more of the staff's preconceptions and design images.

Whereas plans seemed to stimulate little interest, perspectives, sketches, and isometrics drew the greatest response from the group. Positive aspects of designs were acknowledged and changes were suggested. The staff began to realize they weren't being shown finalized designs, but were being asked to contribute to the design by expressing ideas or suggesting modifications.

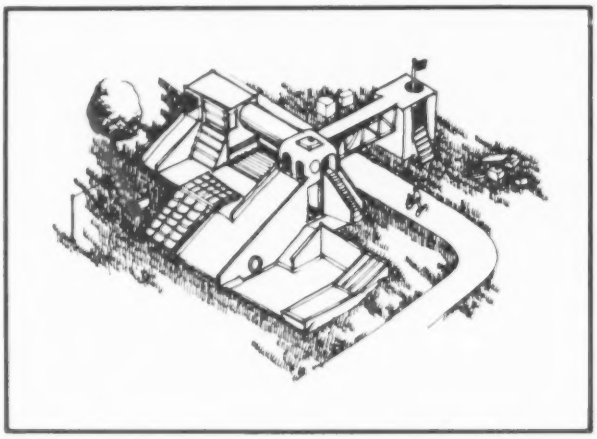
In all of these ways, then, the preliminary sketch design subphase was equally important to



Preliminary sketch design in response to the design principles of continuity and branching and clear accomplishment points.



Preliminary sketch design in response to paced alternatives variety of 3-dimensional spaces, repetition and multiple coding, and retreat and breakaway.



Preliminary sketch design in response to a wide range of developmentally-based design issues and site constraints.

the beginning of design as it was to the continuation and final articulation of the program development process.

Suggestions for the Application of Design Principles

The St. Francis Project involved the interwoven tasks of an extensive review of research, the articulation of behaviorally-based design principles, and the application of those principles to the design of an outdoor environmental learning area. This manual will render these design principles useful for application to other situations, clients, and sites.

Though there are a number of ways the design principles can be utilized by a designer, we found the following approaches most productive.

- In addition to specific information and suggestions, each information sheet provided space for a schematic design applying that particular piece of information. The assembled piles of information sheets provided an immediate source of numerous design ideas for each goal and principle. To provide a similar source of ideas, other designers could take each principle separately and while reading through the supporting discussion of that principle, generate a series of thumb-nail design ideas that give form to the principle. As the designer works through the various principles generating schematic designs, forms may begin to emerge which incorporate several principles at once. Overlaps and complimentary forms can be selected from the growing resource pile for further elaboration and consideration.

- Alternatively, in reviewing the principles, the designer can initially select a limited number of principles that appear cohesive, as was done in our preliminary sketch problem. Schematic designs can be generated which address those principles. The designs can then be evaluated in terms of the other principles. Though a specific preliminary design may directly address only one principle (and thus is only a partial solution), in doing so it should not violate the other principles.

- In reviewing the principles and becoming immersed in them, the designer may find him or herself synthesizing the ideas expressed and suggested into a general design direction. With this approach, the designer can maintain the underlying direction, periodically reviewing the principles as the design proceeds. In this way the design proceeds holistically but is always accountable to, and judged against, the principles.

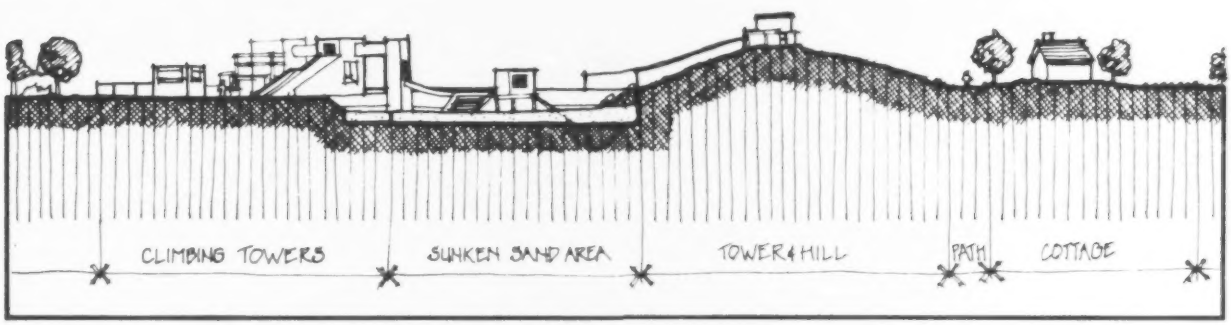
- Designers who prefer to work within their own familiar style can design first and then, using each principle separately, evaluate the design. Modifications can be made accordingly.

- Any of the above approaches can be combined into whatever working style is comfortable. Whatever approach is used, it may prove helpful to annotate the emerging design solutions with the appropriate principles for quick review and evaluation.

Final Design Proposal: The St. Francis Children's Center Play/Learning Environment

For the final design proposal, the design team worked as one unit. The best ideas from all of the preliminary design work were retained for incorporation in this integrated proposal. The team decided upon an overall framework, arrived at an agreed-upon conceptual site design, and divided up the design tasks according to sections of the site.

It was our hope that by moving from the abstract to the concrete, basing early design ideas on behavioral goals and developmental principles, while only allowing materal and cost constraints



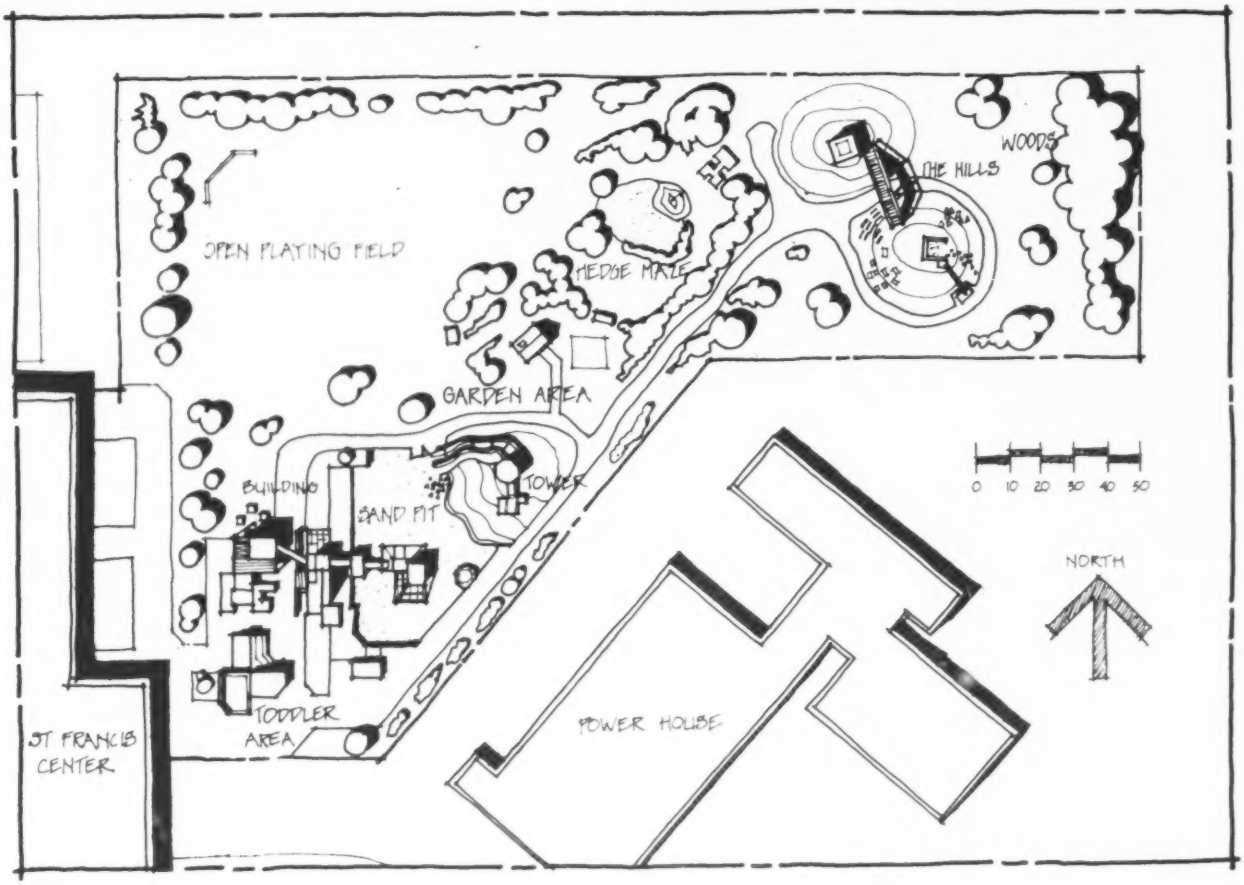
Site section.

to enter at a much later phase, that more creative ideas would arise and that the ideas would be more firmly grounded in the thrust of the design guide and program -- human behavior.

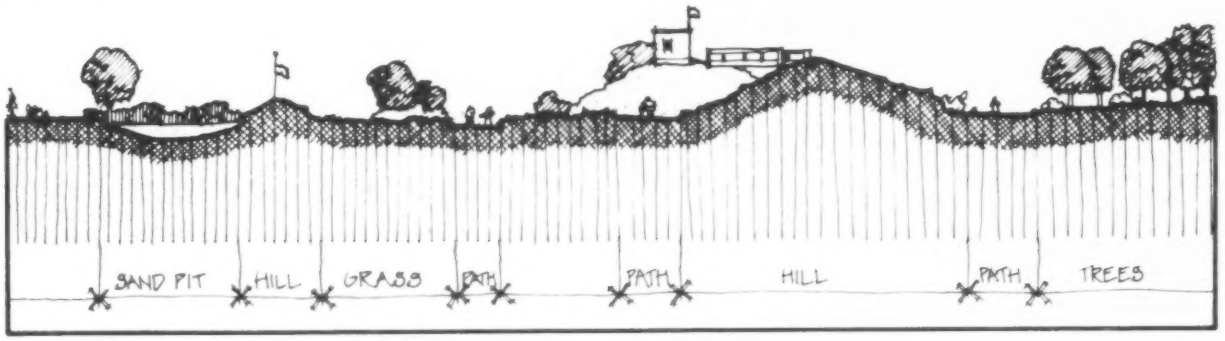
The St. Francis staff reviewed the overall site plan in a final participatory meeting. Using a working model of the site for more complex sections, consensus was reached on the direction of the final design proposal.

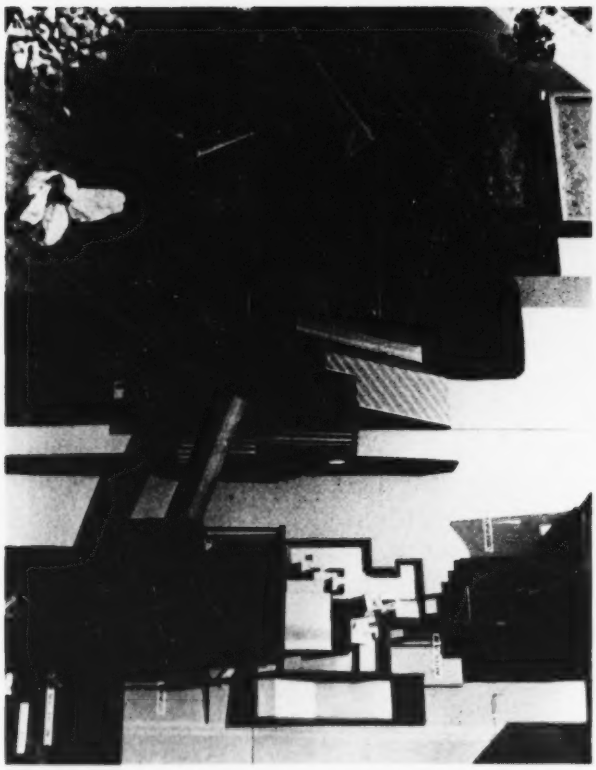
Organizing Concepts in the Site Design

As shown in the accompanying site plan, the St. Francis building is on the lower left, southwest corner and the site extends to the northeast ending in a clump of mature maple and beech trees. The site plan encompasses a series of five interconnected yet distinct zones. They are oriented respectively around an interconnected

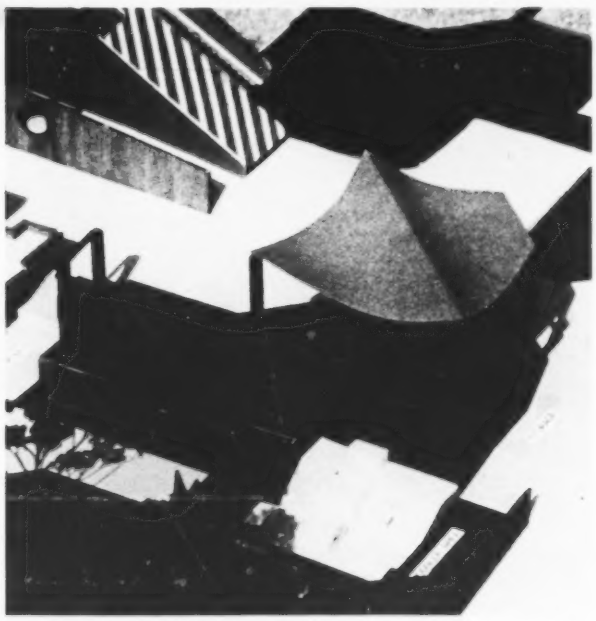


Proposed comprehensive site plan.

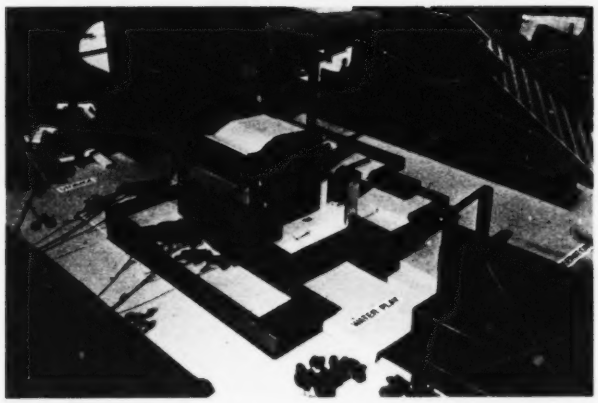




Aerial view of the model for a portion of the project for the St. Francis Children's Center looking east from above the indoor facility.



Toddler area is partially separated from the rest of the play/learn areas. On the other side is a multi-functioning stage, covered play area, and observation deck for adults.



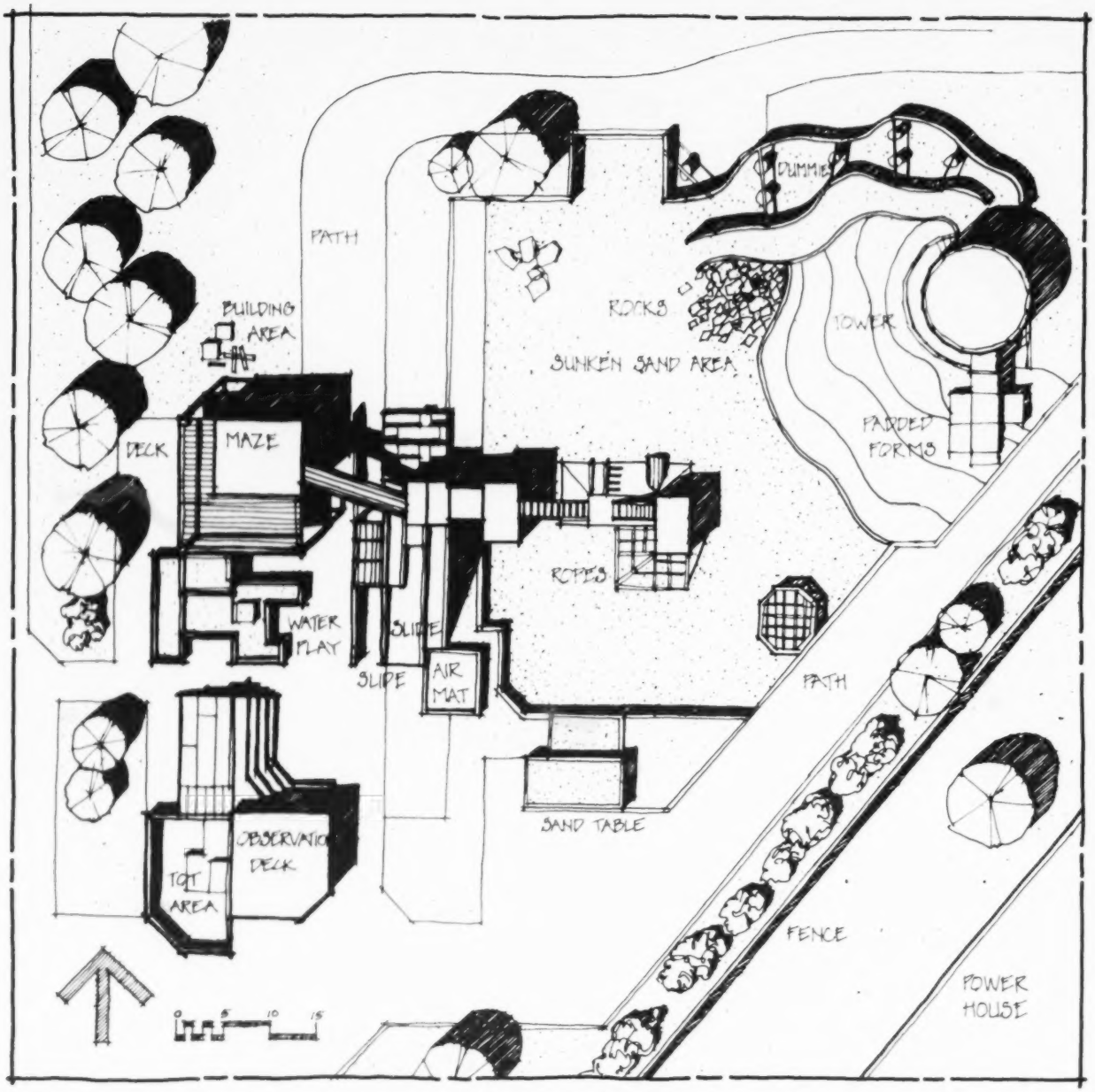
The water play area with fountain, falling waters, and handicapped access. Children can walk or kick in the low water area by sitting on the ledge, or can play at the higher sand and water tables.

series of climbing towers, a hedge maze and garden area, two hills, an open playing field, and the existing woods area. Final design of the various sections was divided between the five members of the design team.

The overall site design followed the staff's preference that a large percentage of the developed portion of the play/learning environment be situated near the building with pathways leading out through the site linking other smaller specialized areas. The basic organizing concept was a gradient of five areas from built to natural environments with clear orientation points along the way.

An open playing field was placed on the flattest, most open part of the site. A hedge maze and garden area and two hills connected by a bridge provide transitions from the built environment to the woods which is to be left to grow in a natural ecological succession with the existing trees, a few hedges and bushes, and tall grass. Brightly colored flags on the tower and on the hill provide imageability to the parts of the site and facilitate orientation through parts of the site.

Various types of paths -- rough, smooth, wood, asphalt, bike, walking, wheelchair, etc. -- link the distinct areas in a connecting web. Each major section, however, has retained a unique character, separate in terms of design style and the developmental goals and principles to which it responds. The section to section differences provide a greater range and variety of stimulation and activity opportunites for the diverse needs of the children who will use the site. By having separate members of the design team focus on different areas, a greater richness in complexity and variety was possible than if a united team had uniformly applied the principles across the site as a whole. Hence, the character of each of these sections -- the climbing towers,

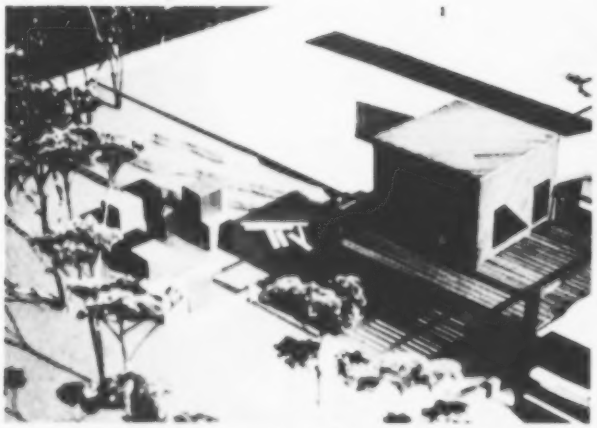


Plan for the interconnected series of built structures, climbing towers, viewing tower, and central sand pit.

hedge maze and garden area, the hills, the playing field, and the woods -- is relatively distinct from one another. The most important unifying factors are the children, their laughs and screams of joy intermixed with quiet exploration.

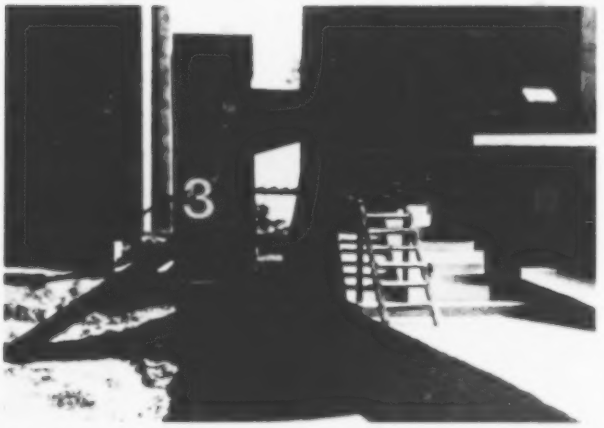
Interconnected Series of Built Structures

The most heavily designed and built-up area of the site is located beside the St. Francis building on the south-western portion of the site. Smaller sub-areas are connected by paths. A central sand pit unifies the area with other built areas feeding out from it. This section includes a toddler area, a dual-functioning observation and play deck, a water play area with handicapped access, a maze, a loose parts building area, a major integrated series of towers, large-muscle area, an emotional explosion area, a viewing tower, a social play area, and various levels of sand and



The loose parts area, a semi-enclosed play area beyond the water play area. Storage for the loose parts is underneath the raised platform and maze.

Across the large sand play area is another sequence of spaces meeting the principles of continuity and branching, variety of 3-dimensional spaces, emotional explosion, and paced alternatives. The rear tower revolves manually. The emotional explosion area is filled with light dummies, including a section for children with orthopedic handicaps. A swing set requires cooperation to get the swings moving.



Large-motor area with paced alternatives to various climbing structures.

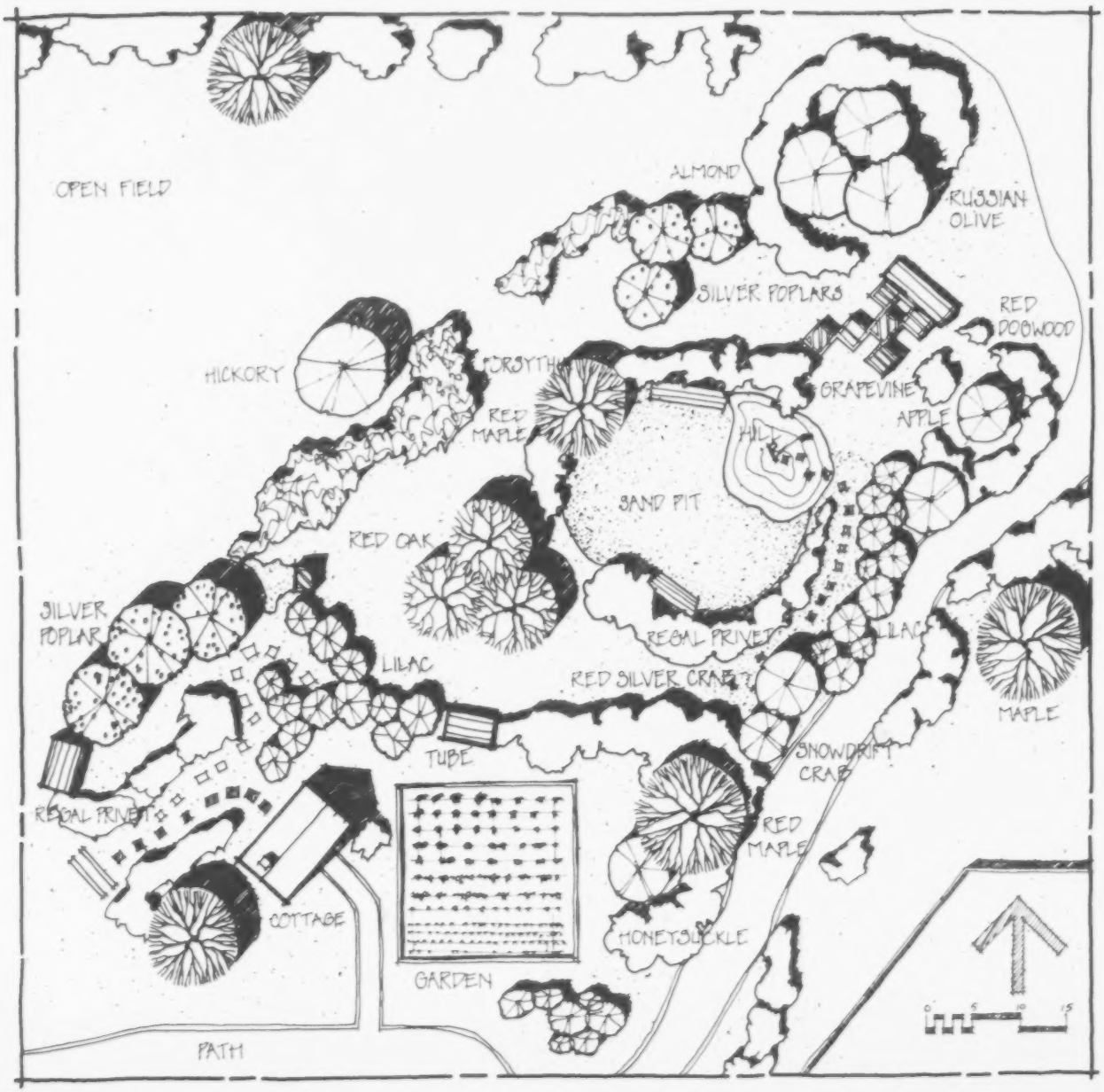
rocks. Each of these sub-areas will be described moving outward from the present building from southwest to northeast.

Very near the building, and closely observable by the staff, is the toddler area where infants and tiny children can learn to stand or walk, fall down, climb, and watch themselves in mirrors. The area has a variety of levels of soft, tactile surfaces, with mirrors on the walls. In a microcosm, it is an example of the application of Paced Alternatives, Range of Social Scale, and a setting for Loose Parts.

Adjacent to this area is an observation deck which also functions as a sociopetal set of steps for groups of children. The two levels of this deck can be used for playing, arts and crafts, testing, etc. A canvas tarp can be placed over the deck in bad weather.

To the north of the toddlers and observation areas is a water play area. The one water source can be controlled by staff from the top of the form where the undulating white surface can be seen. From there the water descends in two directions -- as a four-foot waterfall off the west side of this surface, and down a variety of forms, surfaces, and ponds on the east side. At the bottom the water slides down into a shallow pool for children to splash in. Handicapped access (Barrier-Free Environment) is assured at a watertable on the southeast corner and along gentle ramps on all sides. The scale of all construction on the site is child-sized. The deck behind the water play area, for example, is only five feet above grade.

Above the water play area, a maze on a deck incorporates a Variety of 3-Dimensional Spaces with ladders, slides, and a variety of surfaces integrating the whole.

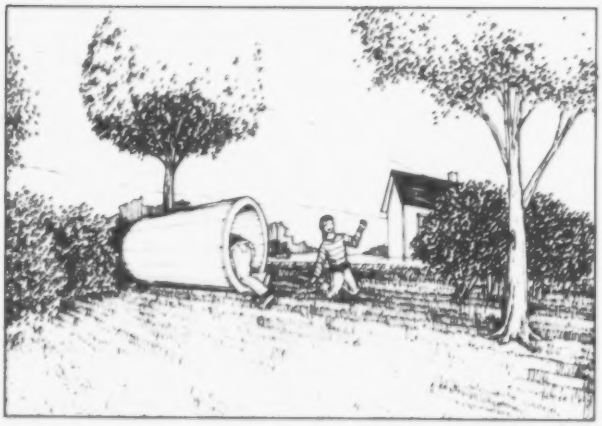


Plan for the hedge maze and garden area.

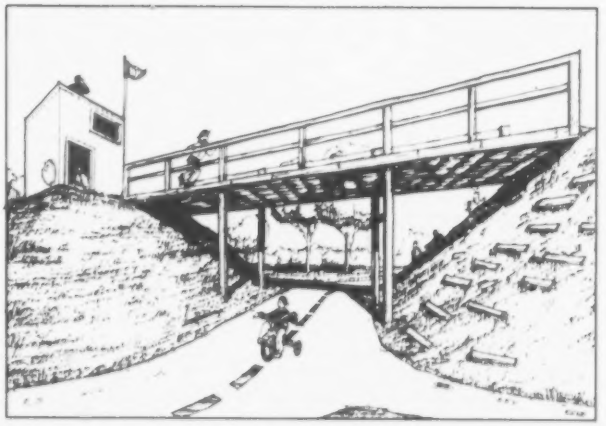
Below the maze is a storage space for the adjacent Loose Parts building area. Here, building components such as a large modular block set and construction materials and tools can be stored for the children to create their own huts and forts.

A circular tunnel connects the maze with the large motor area on the eastern side of the major pathway. This area provides many Paced Alternative routes up, down, and across, with large slides which empty onto a mat and inflated mattress. (See plan on p. 83.)

The climbing towers cater to a full range of motor skills and respond to some of the many other goals and design principles -- Paced Alternatives and Clear Accomplishment Points for confidence building, Repetition and Multiple Coding for cognitive development, and Retreat and Breakaway Areas for social and emotional development. A fantasy-laden hanging



Sketch of one part of the hedge maze area looking south.



Sketch of one part of the hills looking south.

bridge connects the main towers with a third tower and playhouse in the middle of the sand pit (Ambiguous to Defined Spaces).

The central, expansive sand pit unifies the many segments of the built environment (Continuity and Branching) and provides space for the invaluable experiences of modeling and building in the soft plasticity of the earth. An additional area of sand at the southeast corner of the built environment is elevated providing access for the handicapped. While the percentage of wheelchair children at the St. Francis Center is very small, they can participate in sand and water play, the Emotional Explosion Area, most of the hedge maze and parts of the hills to the east.

A variety of activities are provided for in and around the tower at the northeastern corner of the built environment. Visual variety can be experienced with mirrored surfaces and moveable, colored, transparent surfaces which allow the child to view the site in a range of tints. A tall telescope runs from the bottom to the top of the tower.

To the north of the tower is a social play area equipped with swings which can only be swung if a group of children cooperate.

An Emotional Release area runs back down to the sand pit. Here children can throw themselves into the soft swinging dummies or the padded walls. Along the outer wall of this area children can paint or make murals visible to the entire playground. A shorter run responds to Barrier-Free Environment by providing the same opportunity for physically handicapped children.

Hedge Maze and Garden Area

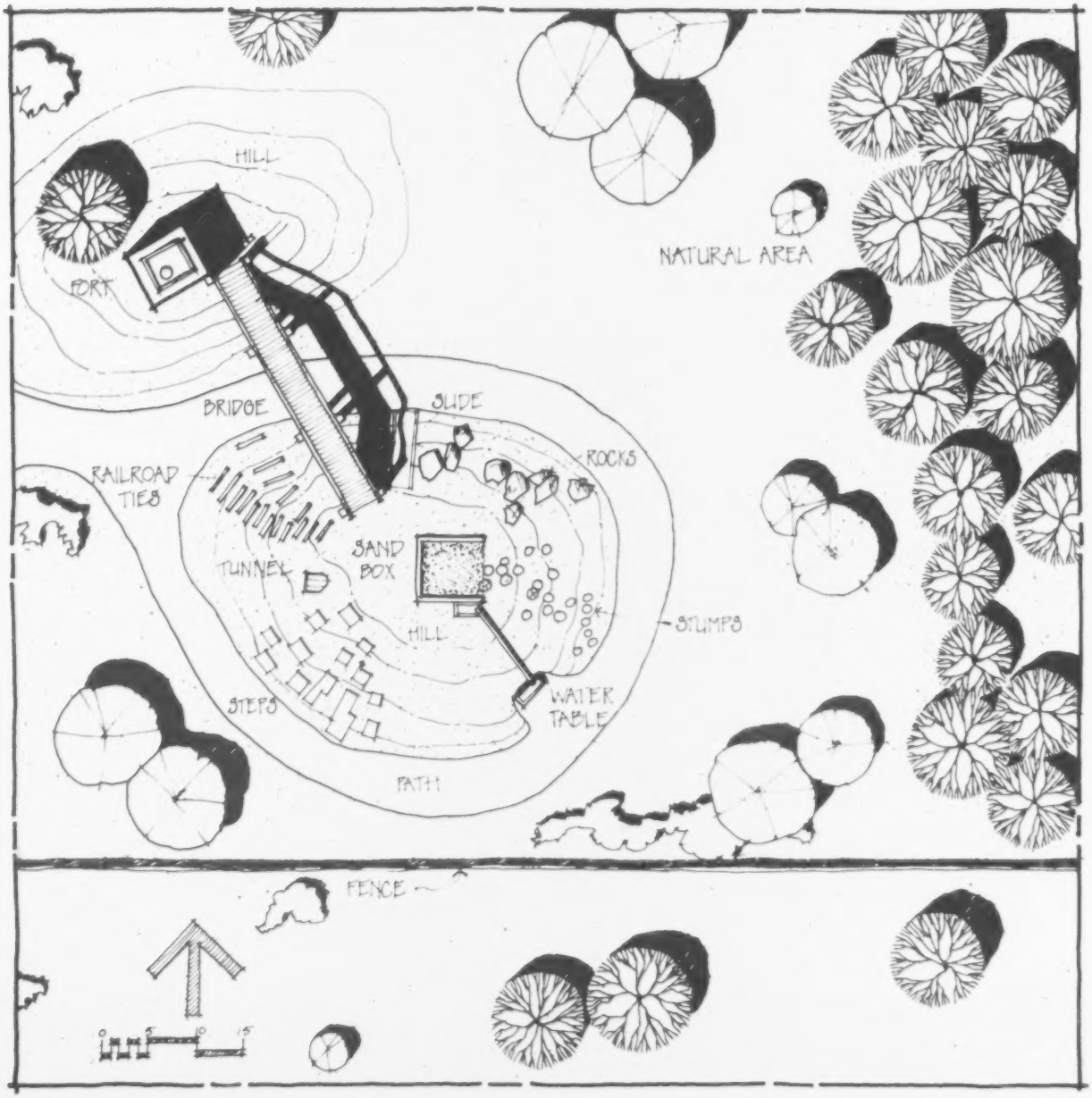
Continuing northeastward up the site toward the woods is the hedge maze and garden area. Here vegetation is used to the maximum for another way of attaining the goals and principles. Trees and bushes provide enclosures and "secret places" for children's retreat, yet furnish a wide range of medium difficult challenges for motor and perceptual skills. Vegetation (see plan, p. 85) has been specially selected for its color, range of blossoming season, and variety of scents. A small cottage positioned on the site serves as an all-weather playhouse and as a storage and plant preparation area. Four garden areas provide ample space for children to tend their own plants and observe their growth.

Though the entry to the maze facing the building is the most perceptually and physically accessible, there are a variety of other entries, paths, spatial experiences, and perceptual-motor challenges. Reaching the top of the hill, a child can see parts of the maze and its layout. The lowest depression of this area is a sand pit which would be rapidly drained due to underlying soil type, providing a private play gully.

The Hills

The hills, which are two hills connected by the "Hills Bridge," combine a series of paced alternatives for motor development and a number of challenges for cognitive development.

The larger, southeastern hill has a variety of climbing surfaces approaching a large sand pit, with a flag pole perched atop the hill. Wooden steps, a slide, tire trails, foam platforms and steps, an open grass slope, a stump forest, and stones and caves all lead to the top at different angles and varying degrees of difficulty. Social interaction, cooperation, and problem-solving skills are all challenged by a water table with a pulley system demanding cooperation and problem solving to haul water up the hill to the sand pit. Fine-motor coordination, imaginative play, and cognitive growth through manipulating materials and discovering their charac-



Plan for the hills.

teristics can all occur in the sand pit.

The taller, northwestern hill is capped with a timber look-out tower and bright flag pole, providing imageability, a view of the entire outdoor site, and orientation to the building and all parts of the site. This hill is steeper and more difficult to ascend, though it is accessible by the bridge. The tower includes an enclosed club room, a look out deck (again difficult to ascend), and a storage area for the loose parts for the hill top building area. Thus, this hill is for more advanced children, yet, being visible from the first hill, it provides a ready challenge for the less-developed children.

Open Playing Field

Located on the northwest corner of the side, this area includes a baseball diamond and space for other surface markings, squares, or circles, for

assisting in organizing games and activities. Being mainly grass, this segment of the site requires the least amount of landscape work and design.

The Woods

Throughout the remainder of the site, trees and shrubs will be used to provide a variety of natural settings. Though extra vegetation is used on the hills and in the hedge maze area, it is most heavily planned in the woods furthest away from the Center on the east of the site. Here, away from the main stream of activity, children developing a beginning independence can find natural places that seem wonderfully far away.

The cluster of trees growing just to the east of the site is to be extended. Otherwise this area will be left relatively wild and untouched, allowing it to grow with potentially dense tree, bush, and ground cover, providing the only ecologically natural area on the site. While this is only a modest attempt at recreating a forest, we feel it is extremely important since these children so seldom experience free, natural settings.

Design Summary

In understanding and knowing the final design solution, and, more important, being able to point out its strengths and weaknesses, there are three things to note. First, the design principles were followed and integrated into the design. By using Repetition and Multiple Coding, for example, as a resource of ideas and a checklist of user requirements, the design team was encouraged to provide slides of different lengths and inclines, slides of varying surfaces and colors, and slides that curved and undulated. It was the design principles that made the site design and concept unified and assured us that the data we collected were being used appropriately.

The second aspect in designing was at a smaller scale, namely using ideas both from our team and from other sources. For example, by seeing what Leland Shaw did with various stair and ramp combinations for orthopedically handicapped children at the Magruder Environmental Therapy Complex in Gainsville, Florida ("Where do the Children Play" film, 1970, plus personal visits), we saw a concordance with the design guide demands for Paced Alternatives and extended this idea freely.

Or by seeing what Eric MacMillan did with soft tackling dummies at Children's Village in Toronto (see Cohen, Moore, and McGinty, 1978, based on personal field research), we saw a concordance with the program demands for emotional release and subsequently developed an area which became our Emotional Explosion area and design principle.

The third aspect, which is one of intuition, based on our own memories of childhood and of that of our own children, further guided us to the final design by helping us to know what kids like to do and how they learn and grow through play. In other words, what do kids think is fun? The thrill of sliding down a slide that seems almost too scary, the fun of splashing in water, or the feeling of self accomplishment from building one's own sandcastle or fort were all part of the attitude we had from the first stage of putting pencil to paper before any design principle evolved through to the final stages of design.

Design as a Response to Behaviorally-Based Principles

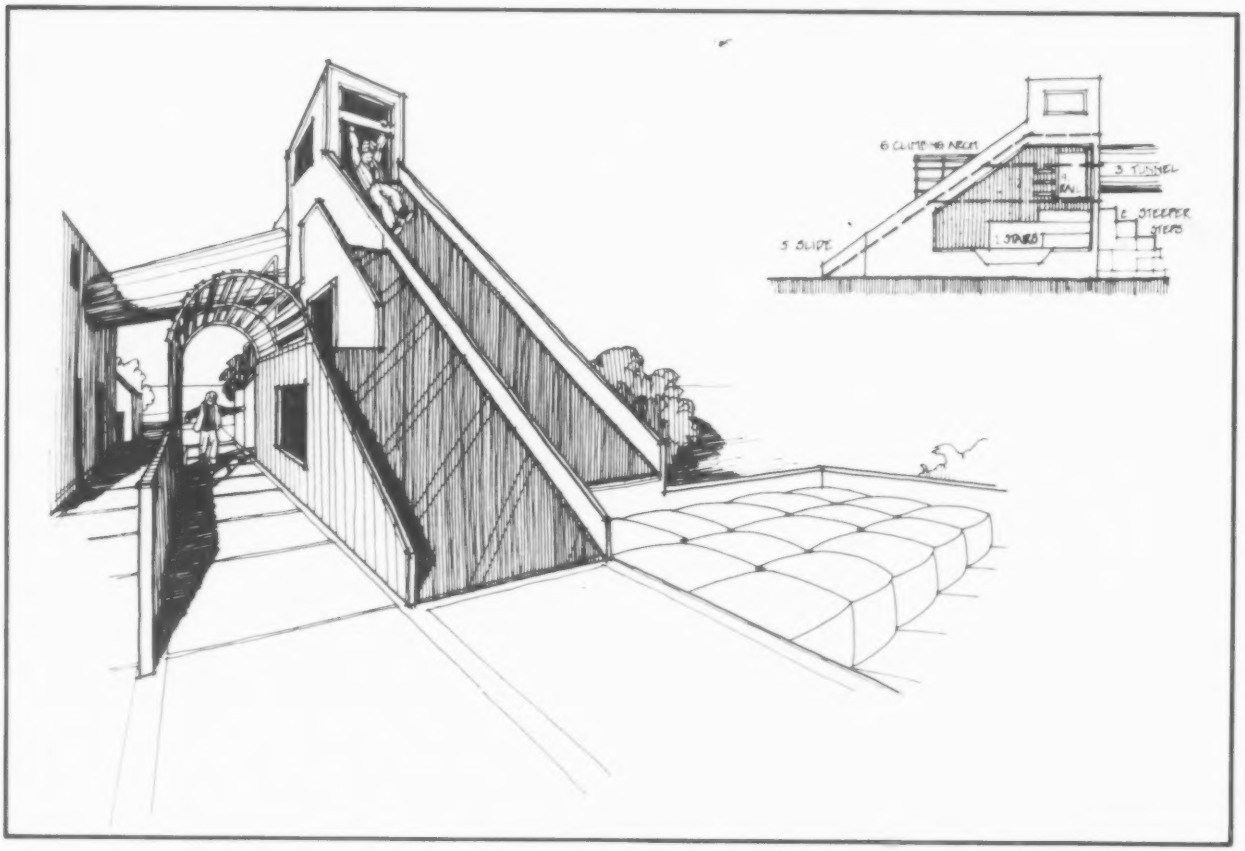
Design is the specific plan of arranging the various components of a setting, enclosing people and their behavior by limiting or enhancing the range of activities that may take place in that setting. Though there have been many classic dictates of design -- cost, materials available, and trends in style -- human behavior is emerging as a justifiable, primary basis for design.

An increased awareness of the interrelationships involved between the near environment and the behavior of individuals in that environment has led to a desire on the part of more designers to base their decisions on behavioral information. However, the circularity of the relationships between humans and their environments is often confounding.

We alter our environment to suit a perceived need. The altered environment then "acts on" us by surrounding us with a set of conditions. We then act, or behave, in response to those imposed conditions. Momentarily, we need to stand back and assess this circle of interactions as it pertains to design. This is the task of all involved in environmental planning, though the major research effort is being assumed by those in the growing field of environment-behavior studies. However, the increasing body of behavioral research information is not customarily presented in a form immediately usable by those involved in design work. Design principles based on behavioral information, therefore, seem to provide the needed, effective link between research and design by translating behavioral data into operational design guidelines.

Application of Design Principles

To illustrate the embodiment of a design principle in a specific component of the St. Francis Center Play/Learning Environment, three princi-



Slide tower illustrating the application of the paced alternatives design principle. The tower was influenced by several principles, as were all parts of the design, though in this case paced alternatives was predominant.

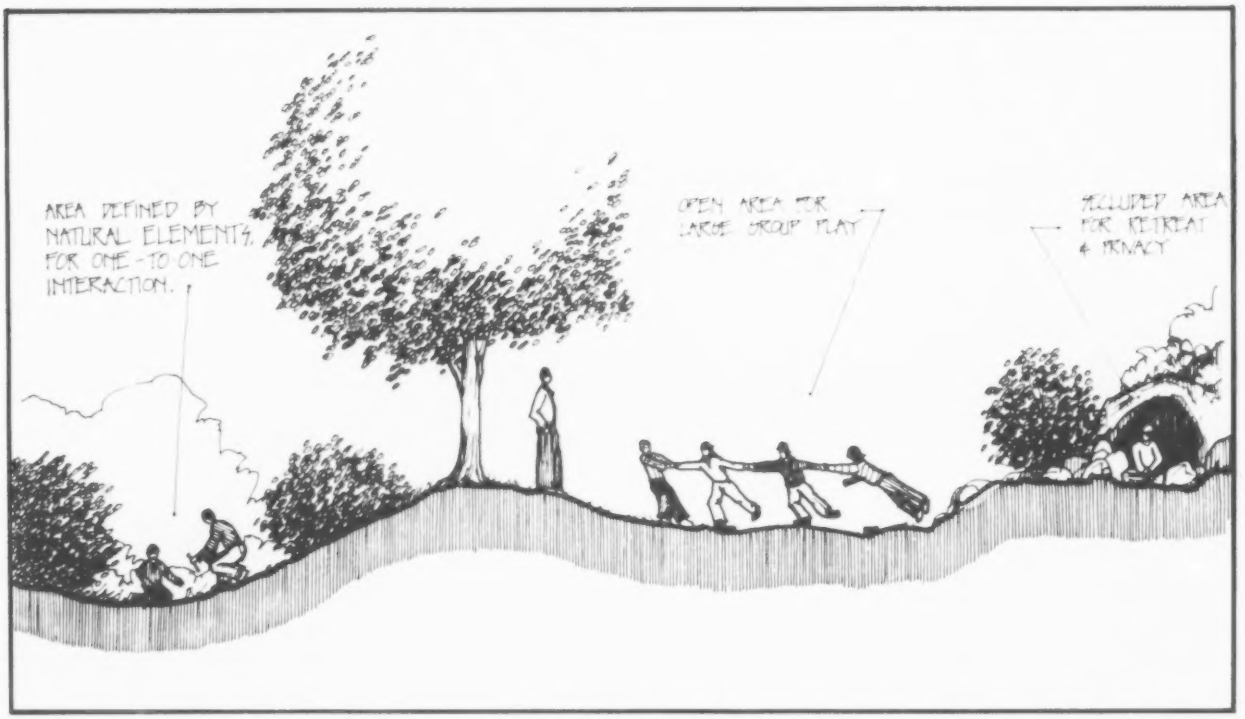
ples and their concrete application will be shown. These are Paced Alternatives applied to a slide construction in the built environment, Range of Social Scale applied to the Hedge Maze, and Loose Parts evidenced in several portions of the site.

Paced Alternatives

The central idea in Paced Alternatives is the provision of choices within like activities for varying degrees of challenge. Applying this principle to the activity of sliding, it became evident that several factors needed to be considered within the sliding experience.

Climbing and entry points to the slide would have to accommodate different levels of motor skills. Height, pitch, and width of the slide should provide graded challenges. Similarly, landing surfaces might need to vary from "completely secure" to "more challenging." The slide structure shown in the accompanying illustrations responded to these requirements in a variety of ways.

- Several modes of entry are possible offering the child a choice of difficulty. Simple stairs, pitched ladders, a climbing arch, and a rope rail up the slide require varying degrees of skill and confidence, but all provide access to the slides.
- Three sliding surfaces varying in height, width, and pitch, all allowing the whoosh feeling of sliding, but in varying degrees of "thrillingness."
- Secure protective edges, wide platforms, and ample handrails and grips are provided at the junction points -- those places where a child must re-position him or herself from the climb up to get into a sliding posture. Confidence at these points is necessary for the child to continue with the challenge.
- Air mattresses, mats, and sand are offered as alternative landing surfaces. The child can choose between the complete security of a soft landing or the more challenging sand pit which requires some balance.


AREA DEFINED BY NATURAL ELEMENTS FOR ONE-TO ONE INTERACTION.
OPEN AREA FOR LARGE GROUP PLAY
SECLUDED AREA FOR RETREAT & PRIVACY

Part of the woods natural environment illustrating the application of range of social scale.

Loose Parts

The principle of Loose Parts expresses the important developmental need of children to manipulate and alter their environment and see themselves as effective "doers" or agents of change. As the major part of most settings is immovable by the child, manipulable parts need to be intentionally planned.

In providing Loose Parts in the play environment, several factors needed to be considered. Children need to handle a wide variety of materials, to experience ranges of textures, smells, plasticity, and to discover what different items can do. Ground surface materials, sand, gravel, bark chips, as well as water and plant materials, all respond to this principle. Preformed construction sets and free-form building materials and tools can be provided in designated areas for additional experiences. The play environment provided many opportunities for applying this example.

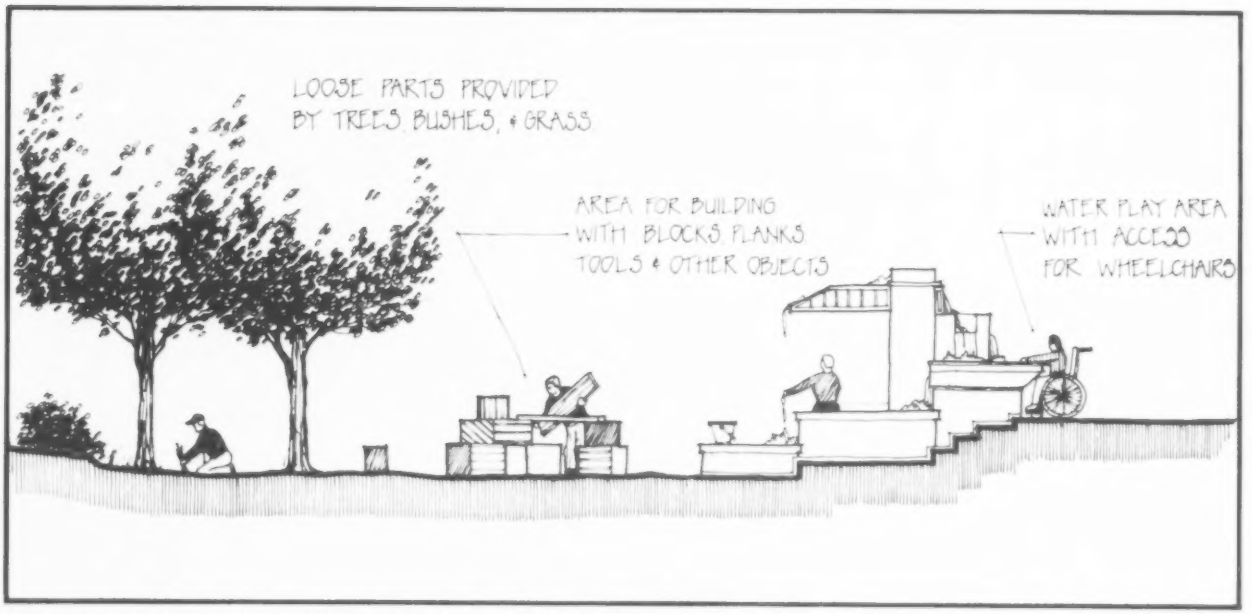
- An extensive sand pit is centrally positioned allowing easy access and ample space for a large number of children to experience the special plasticity of sand play. An additional elevated sand area allows barrier-free access for physically handicapped children.
- A wide variety of water-play experiences is possible in the system of interconnected pools and water tables. Nearby storage is provided for cups, funnels, shovels, and other items for sand and water play.
- The Loose Parts building area provides space for construction activities and storage of materials and tools.
- Landscaping throughout and surrounding the built environment provides numerous incidental Loose Parts in the way of leaves, twigs, and grass.

Range of Social Scale

Range of Social Scale expresses the need for different sizes of spaces for individual and group activities. The need to be alone, enclosed privately by the environment, the need for a small area for a few individuals to work undistracted, and the need for expansive areas for larger groups to play games and run freely are encompassed in this principle.

While responding to and incorporating a variety of principles, the hedge maze area directly addresses Range of Social Scale. Shrubs, trees, and pathways freely wind into patterns that form spaces of varying group size and scale.

- Tiny caves surrounded by child-high bushes provide places for just sitting alone and pretending, yet allow some surveillance by adults.
- Teacher and child twosomes can find numerous



The loose parts area northwest of the water play area and the climbing tower.

private areas for working on a skill or play task without the intrusive gaze of others.

- Larger, semi-secluded areas, such as the gully, allow small groups the space where children can play near, but not necessarily with, other children as they gain social skills.
- Beyond the hedge row, the playing field provides free uninterrupted game and running space for small to larger groups.

Summary and Conclusions

This book has summarized the substantive findings and design ideas from an applied research, programming, and design project for exceptional children. Information was collected from existing research literature, interviews with exceptional education staff members, observations of exceptional children, participatory games with the client group, consultants, and a building type analysis. Results from the project have been presented in terms of a range of behaviorally-based, design-relevant information, and have been summarized in a design guide for exceptional education. The backbone of the design guide are fourteen developmental goals to which the design of environments for exceptional education should respond, and fourteen design principles derived from these goals which should enable the environment to be designed to better serve the needs of exceptional children. The design case study illustrates the application of the design guide to a particular site, and was intended to help readers use the design guide in other applications.

This project and book are a first step in generating design principles for exceptional education environments. Many questions remain about the role of the physical environment in helping children to overcome learning and physical disabilities. Though it is possible to transfer some findings from one user group to another, e.g., from children in general to exceptional children, extreme caution must be exercised as these two groups are so different. Yet there is considerably more hard empirical research on the relations of average children and their environment than there is with respect specifically to exceptional children. Considerably more research is needed, especially innovative empirical research. Testing is required on the applicability and power of the foregoing design principles, and more fundamental relations between exceptional children and their physical environment need to be uncovered. Original research would set the stage for soundly based design principles and for more rational design applications.

References

For ease of use, the following references from the text are listed alphabetically but coded with an index number corresponding to six areas of literature bearing on the design of environments for exceptional education:

1. Child Development and Exceptional Education
2. Exceptional Education and the Physical Environment
3. Environment and Physical Disabilities
4. Design Guides
5. Descriptions of Facilities
6. Methods

2 Abeson, A. & Blacklow, I. Environmental Design: New Relevance for Special Education. Arlington, Va.: Council for Exceptional Children, 1971.

4 Alexander, C., Ishikawa, S., & Silverstein, M. A Pattern Language: Towns, Buildings, Construction. New York: Oxford University Press, 1977.

2, 5 Allen, Lady, of Hurtwood. Planning for Play. Cambridge, Ma.: MIT Press, 1968.

1,2 Ayers, A. J. Sensory Integration and Learning Disorders. Los Angeles: Western Psychological Services, 1972.

2,3,4 Bayes, K. The Therapeutic Effect of Environment on Emotionally Disturbed and Mentally Subnormal Children. Old Woking, England: Unwin Bros., 1967.

2,4 Bayes, K. & Francklin S. (Eds.) Designing for the Handicapped. London: George Godwin, 1971.

3 Bednar, M. J. (Ed.) Barrier-Free Design. Stroudsburg, Pa.: Dowden, Hutchinson & Ross, 1977.

2,4 Bednar, M. J. & Haviland, D. S. Role of the Physical Environment in the Education of Children with Learning Disabilities. Troy, N.Y.: Rensselaer Polytechnic Institute, Center for Architectural Research, 1969.

4,5 Bengtsson, A. Environmental Planning for Children"s Play. New York: Praeger, 1970.

3,4 Birch, J. W. & Johnstone, B. K. Designing Schools and Schooling for the Handicapped. Springfield, Ill.: Thomas 1975.

1 Birren, F. Color, Form, and Space. New York: Reinhold, 1961.

1 Bower, T. G. R. Stimulus variables determining shape perception in infants. Science, 1965, 149, 88-89.

1 Bruner, J. S., Olver, R. R., and Greenfield, P. M. Studies in Cognitive Growth. New York: Wiley, 1966.

3 Bureau of Education for the Handicapped. Better Education for the Handicapped. Washington, D. C.: U. S. Government Printing Office, 1969, 1970.

4 Cherry, C. Creative Play for the Developing Child. Belmont, Ca.: Fearon, 1976.

6 Cohen, U. Environment-behavior research and architectural programming: an example of design applications to unfamiliar settings. In S. Weidemann, J. R. Anderson, and R. Brauer (Eds.) Priorities for Environmental Design Research. Washington, D.C.: Environmental Design Research Association Publications, 1978, pp. 27-32

6 Cohen, U. and Moore, G. T. The organization and communication of environment-behavior research information in architectural programming. In L. van Ryzin (Ed.) Behavior-Environment Research Methods: Proceedings of the Wisconsin Conference. Madison: University of Wisconsin-Madison, Institute for Environmental Studies, 1977, pp. 77-93.

5 Cohen, U., Moore, G. T., and McGinty, T. Case Studies of Child Play Areas and Child Care Facilities. Milwaukee: Community Design Center and University of Wisconsin-Milwaukee, Center for Architecture and Urban Planning Research, 1978.

4,5 Cooper, C. C. Easter Hill Village: Some Social Implications of Design. New York: Free Press, 1975.

1 Cratty, B. J. Perceptual and Motor Development in Infants and Children. New York: Macmillan, 1970.

1,2 Cruickshank, W. M. The Brain Injured Child in Home, School, and Community (Rev. ed.). Syracuse: Syracuse University Press, 1977.

2 Cruickshank, W. M. and Quay, H. C. Learning and physical environment: the necessity for research and research design. Exceptional Children, 1970, 261-268.

1 Department of the Environment. Children at Play. London: Her Majesty's Stationery Office, 1973.

1 Dreyfuss, H. The Measure of Man: Human Factors in Design (2nd ed.). New York: Whitney Library of Design, 1967.

1 Dunn, L. Exceptional Children in the Schools. New York: Holt, Rinehart and Winston, 1965.

1 Flavell, J. H. The Developmental Psychology of Jean Piaget. Princeton, N.J.: Van Nostrand, 1963.

1 Garvey, C. Play. Cambridge, Mass.: Harvard University Press, 1977.

1 Gesell, A. The First Five Years of Life. New York: Harper and Bros., 1940.

1 Gesell, A. & Ilg, F. The Child from Five to Ten. New York: Harper and Row, 1946.

3,4 Goldsmith, S. Designing for the Disabled (3rd ed.). London: Royal Institute of British Architects Publications, 1976.

5 Gordon, R. The Design of a Pre-School "Learning Laboratory" in a Rehabilitation Center. New York: New York University Medical Center, Institute of Rehabilitation Medicine, Rehabilitation Monograph 39, 1969.

5 Gordon, R. The Design of a Pre-School Therapeutic Playground: An Outdoor "Learning Laboratory"--The Jesse Stanton Developmental Playgournd for Pre-School Handicapped Children. New York: New York University Medical Center, Institute of Rehabilitative Medicine, Rehabilitation Monograph 47, 1972.

2 Graff, M., Oertel, J., & van Ryzin, L. J. Programming and design of environments for learning disabled children. In S. Weidemann, J. R. Anderson, & R. Brauer (Eds.) Priorities for Environmental Design Research. Washington, D.C.: Environmental Design Research Association Publications, 1978, pp. 529-530.

1 Grey, A. Creative learning in children's playgrounds. Childhood Education, May 1969, 45, 491-499.

2,3 Handicapped Adventure Playground Association. Adventure Playgrounds for Handicapped Children. London: Author, 1975.

1 Hart, R. The genesis of landscaping: two years of discovery in a Vermont town. Landscape Architecture, October 1974, 65, 356-363.

1 Hart, R. A. & Moore, G. T. The development of spatial cognition: a review. In R. M. Downs & D. Stea (Eds.) Image and Environment: Cognitive Mapping and Spatial Behavior. Chicago: Aldine, 1973, pp. 246-295.

1 Hesselgren, S. Man's Perception of Man-Made Environment. Stroudsburg, Pa.: Dowden, Hutchinson & Ross, 1975.

BEST COPY AVAILABLE

1 Hole, V. Children's Play on Housing Estates. London: Her Majesty's Stationery Office, Building Research Station Research Paper 39, 1966.

1 Holt, J. Children are sensitive to space. Progressive Architecture, April 1973, 54, 113-117.

1 Ilg, F. L. & Ames, L. B. Child Behavior from Birth to Ten. New York: Harper & Row, 1955.

6 Ittelson, W. H., Rivlin, L. G., & Proshansky, H. M. The use of behavioral maps in environmental psychology. In H. M. Proshansky, W. H. Ittelson, and L. G. Rivlin (Eds.) Environmental Psychology. New York: Holt, Rinehart and Winston, 1971, pp. 664-668.

1 Johnson, D. J. & Myklebust, H. R. Learning Disabilities: Educational Principles and Practices. New York: Grune & Stratton, 1967.

1 Johnson, R. C. & Medinnos, G. R. Child Psychology: Behavior and Development. New York: Wiley, 1974.

6 Jones, J. C. Design Methods. London: Wiley, 1970.

3,4 Jorgensen, J. Landscape Design for the Disabled. McLean, Va.: American Society of Landscape Architects Foundation, 1975.

1,2 Kephart, N. C. The Slow Learner in the Classroom. Columbus, Oh.: Merrill, 1960.

1 Kirk, S. A. Educating Exceptional Children (2nd ed.) Boston: Houghton Mifflin, 1972.

5 Learning can be fun. Industrial Design, November 1970, 17, 26-33

2 Lehman, C. Head Start services for the handicapped in Wisconsin. Paper presented at a Conference on Early Childhood Education for the Handicapped, University of Wisconsin-Milwaukee, January 1977.

3,4 Mace, R. & Laslett, B. (Eds.) An Illustrated Handbook of the Handicapped Section of the North Carolina State Building Code. Raleigh, N.C.: Governor's Study Committee on Architectural Barriers, 1974.

1 Melcher, J. Disposition to the U. S. Office of Education, Bureau of Education for the Handicapped, October 14, 1977. (Cited in K. R. Blessing. Prevalence of EEN children. Bureau Memorandum (Wisconsin Department of Public Instruction, Division for Handicapped Children), 1978, 19(4), 3-8.)

6 Merton, R. K. & Kendall, P. L. The focussed interview. American Journal of Sociology, May 1946, 2(6), 541-557.

6 Michelson, W. H. Behavioral Research Methods in Environmental Design. Stroudsburg, Pa.: Dowden, Hutchinson & Ross, 1975.

1 Millar, S. The Psychology of Play. Harmondsworth, England: Penguin, 1968.

6 Moore, G. T. Research-and-design for persons in environments. Unpublished working paper, School of Architecture and Urban Plannings, University of Wisconsin-Milwaukee, March 1975. (Mimeo.)

1 Moore, G. T. Philosophy and Issues in the Design of Play Environments. Special issue of the Childhood City Newsletter, November 1976(a), Whole No. 7.

1 Moore, G. T. Theory and research on the development of environmental knowing. In G. T. Moore and R. G. Golledge (Eds.) Environmental Knowing: Theories, Research, and Methods. Stroudsburg, Pa.: Dowden, Hutchinson & Ross, 1976(b), pp. 138-164.

2 Moore, G. T. The design of therapeutic play environments for learning-disabled children. Paper presented at the Association for Children with Learning Disabilities Conference, San Francisco, March 1979.

1 Moore, G.T., Burger, H., & Katz, E. Adventure playground and neighborhood play compared. Paper presented at the Environmental Design Research Association Conference, Buffalo, June 1979.

2 Moore, G. T. & Cohen, U. Exceptional education and the physical environment. In W. E. Rogers & W. H. Ittelson (Eds.) New Directions in Environmental Design Research. Washington, D. C.: Environmental Design Research Association Publications, 1978, pp. 259-286.

1 Moore, G. T. & Pholeros, P. Playground evaluation in Sydney. In J. Allen (Ed.) The Kids' Catalogue: Re/Sources for Learning and Living in Australia. Melbourne, Australia: Greenhouse Publications, 1975, pp. 86-88.

1 Moore, G. T. & Rose, P. Evaluation and design of children's environments: three inner-city playgrounds in Sydney, Australia. Paper presented at the Environmental Design Research Association Conference. Vancouver, Canada, May 1976.

2 Moore, G. T. & Shaw, L. G. (1978) Developmental approaches to the design of environments for children with learning disabilities. Paper presented at the Seventh World Congress of the International Playground Association, Ottawa, Canada, August 1978.

1 Moore, G. T. & Smith, D. Evaluating the built environment: how to keep architects from crying and make everybody happier. Architecture in Australia, December 1975, 64(6), 65,68.

1,2 Moran, J. M. & Kalakian, L. H. Movement Experiences for the Mentally Retarded or Emotionally Disturbed Child. Minneapolis: Burgess, 1974.

1 Myklebust, H. R. (Ed.) Progress in Learning Disabilities (3 Vols.). New York: Grune & Stratton, 1968.

3,4 Nellist, I. Planning Buildings for Handicapped Children. Springfield, Ill.: Thomas, 1970.

1 Nicholson, S. How not to cheat children: the theory of loose parts. Landscape Architecture, October 1971, 62(5), 30-34.

4 Ontario Department of Education Special Education Facilities: Schools and Playgrounds for Trainable Mentally Handicapped Children. Toronto: Ontario Department of Education, School Planning and Building Research Section, 1971.

4 Osmon, F. L. Patterns for Designing Children's Centers. New York: Educational Facilities Laboratories, 1971.

2 Osmond, H. Function as the basis of psychiatric ward design. Mental Hospitals, 1957, 8, 23-29.

1 Piaget, J. The Origins of Intelligence in Children. New York: Norton, 1963.

1 Piaget, J. & Inhelder, B. The Child's Conception of Space. New York: Humanities Press, 1956.

1 Piaget, J. & Inhelder, B. The Psychology of the Child. New York: Basic Books, 1969.

1 Pick, H. L., Jr. & Pick, A. D. Sensory and perceptual development. In P. H. Mussen (Ed.) Carmichael's Manual of Child Psychology (3rd ed.), Vol. 1. New York: Wiley, 1970, pp. 773-848.

5 Playing to learn Progressive Architecture, November 1970, 51, 80-82.

1 Prak, N. L. The Visual Perception of the Built Environment. Delft, The Netherlands: Delft University Press, 1977.

3,4 Ries, M. L. Design Standards to Accommodate People with Physical Disabilities in Park and Open Space Planning. Madison, Wi.: University of Wisconsin-Extension, Recreation Resource Center, 1973.

2,4,5 Sardhee, J. S. & Jansen, H. H. Environmental Design for Handicapped Children. London: Saxon House, 1974.

6 Sanoff, H. (1968) Techniques of Evaluation for Designers.

Raleigh, N.C.: North Carolina State University, School of Design, 1968.

6 Sanoff, H. Methods of Architectural Programming. Stroudsburg, Pa.: Dowden, Hutchinson & Ross, 1977.

4 Shaw, L. G. Design guidelines for handicapped children's play environment. In P. F. Wilkerson (Ed.) Play in Human Settlements. London: Croom Helm (in preparation).

2,5 Shaw, L. G. & Robertson, M. F. The Playground: The Child's Creative Learning Space. Gainsville, Fl.: University of Florida, College of Architecture, Bureau of Research, n.d. (Mimeo.)

3,4 Steinfeld, E. Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People: ANSI A 117.1 (1977). Syracuse, N.Y.: Syracuse University, School of Architecture, Research Office, 1977.

5 Stone, G. Play and Playgrounds: A Report. Washington, D.C. National Association for the Education of Young Children, 1970.

1,2 Strauss, A. A. & Lehtinen, L. E. Psychopathology and the Education of the Brain Injured Child. New York: Grune & Stratton, 1947.

1 Sutton-Smith, B. Research and thought about children's play. Special issue of Leisure Today, June 1972. Reprinted in L. L. Neal (Ed.) Leisure Today: Selected Readings. Washington, D. C.: American Association for Leisure and Recreation, 1975.

1 Sweeney, T. B. Human beings and playgrounds. Journal of the National Association for Women Deans, Administrators, Counselors, Spring 1977, 92-95.

4 Texas A & M University. Environmental Criteria: MR--Preschool Day Care Facilities. College Station, Texas: Texas A & M University, College of Architecture and Environmental Design, 1969.

5 United Cerebral Palsy Association of Miami. Exterior Sensory Learning Environment. Miami: Author, n.d.

5 U. S. Department of Housing and Urban Development. A Playground for All Children, 3 Vols. Washington, D.C.: U. S. Government Printing Office, 1978.

5 Utzinger, R. C. Some European Nursery Schools and Playgrounds. Ann Arbor, Mi.: University of Michigan, Architectural Research Laboratory, 1970.

1 van Ryzin, L. Environmental manipulability in children's play settings. Unpublished Ph.D. dissertation, Department of Educational Administration, University of Wisconsin-Madison, 1978.

5 Vance, B. U. S. Adventure Playground Report. San Francisco: American Adventure Playground Association, 1978.

1 Wallace, G. & McLoughlin, J. A. Learning Disabilities: Concepts and Characteristics. Columbus, Oh.: Merrill, 1975.

1 Werner, H. Comparative Psychology of Mental Development (Rev. ed.) New York: International Universities Press, 1947.

5 Where Do the Children Play. Gainesville, Fl.: University of Florida, College of Architecture, Bureau of Research, 1970. (Film)

1 Wilkerson, P F. Safety in children's formal play environments. Paper presented at the International Playground Association Conference, Ottawa, Canada, August 1978.

5 Witengier, M. An Adaptive Playground for Physically Disabled Children with Perceptual Deficits: The Magruder Environmental Therapy Complex. Orlando, Fl.: Orange County Board of Public Instruction, Forrest Park School, n.d.

Index

Accomplishment points, 59, 67, 68, 78-79, 85
Adler Playground, 51 illus.
Adventure playgrounds, 17 illus., 18, 23-24, 62, 71
Ambiguity, 17, 18, 20, 57
  range of, 63, 64, 79, 85-86
Anthropometrics, 30, 41-42, 71-73
Architectural cues, 18, 54, 57, 60, 63, 66
  repetition of, 60, 79, 85, 88
Barrier-free environments, 16, 22-23, 72-73, 82, 86
Child care centers, 16, 17 illus., 49-50 illus., 54-55, 57 illus., 60 illus., 66 illus.
Child development, 41-51
  areas of, 43
  and design principles, 52-53, 80, 88, 92
  stages, 43-46
Children's Village, Ontario Place, 67 illus., 70 illus.
Circulation, 17, 19, 54, 57 illus., 60 illus.
Continuity and branching, 19, 54, 78-79, 83-84, 86
Cognitive development, 44-45, 47-50
  and environment, 54, 57, 60-63, 65-66
Design guides, 16, 26, 31
  use of, 32-34, 80, 88-91
Design principles, 17-21, 30-31, 52-73, 78-91
  and human development, 52-53, 88, 92
Design process, 26-32, 78-80, 92
Developmental disabilities, 9-16
  incidence of, 9, 13-14
  and the physical environment, 14-16, 92
Emotional disturbances, 13, 14, 67
Emotional release areas, 68, 70, 84, 86, 88
Environmental cognition, 49, 65-66
Exploration, 18, 47-48, 54, 61-62, 66, 68
Exterior Sensory Learning Environment, 25-26, 58 illus.
Group sizes, 17, 55-56, 79, 84, 90-91 illus.
Harbourfront Adventure/Creative Playgrounds, 24, 61 illus.
Harold E. Jones Child Study Center, 57 illus., 60 illus.
Huntington Beach Adventure Playground, 17 illus., 19 illus.
Hyperactivity, and environment, 15, 64
Jesse Stanton Developmental Playground, 15 illus., 22-23, 72 illus.
Learning disabilities, 10, 13-15
  and environment, 64
Loose parts, 18, 20, 61-62, 83-85, 90 illus.
Mainstreaming, 9, 14, 76
Magruder Environmental Therapy Complex, 25
Mental retardation, 10, 12, 14, 67
Motor development, 44-47
  and environment, 54, 58-59, 61-62, 65-66, 67, 72-73
National Child Research Center, 50 illus.
Natural environments, 19, 20, 47 illus., 70, 88
Orientation, 17, 18, 57, 64, 79, 82
Paced alternatives, 58-59, 78-79, 84-85, 89 illus.
Pacific Oaks College Children's School, 17 illus.
Peacock's Point Park, 51 illus., 67 illus.
Perceptual development, 47, 48-49
  and environment, 54, 60, 65-66
Perceptual disabilities, 10, 12
  and environment, 56, 60, 64
Physical disabilities, 10, 11-12, 15
  and environment, 72-73
Post-occupancy evaluation, 21, 27, 32-33, 92
Privacy, 19, 55, 68
Programming, facility, 26, 30, 76-77
Retreat and breakaway areas, 15, 19, 62, 68-70, 85, 91 illus.
Safety, 71
St. Francis Children's Center, 6, 7, 11 illus., 28, 47 illus., 75-78
  Outdoor Play/Learning Environment, 54 illus., 80-91
Satalite Americana Preschool, 66 illus.
Scale, 17, 19, 20
Schools, 9, 11 illus., 14, 37-41, 47 illus., 54-55, 61, 75-78
Self-concept, 50, 58, 61, 67, 68
Sensory stimulation, 15, 18-20, 57, 64
  repetition of, 18, 68-70
Social-emotional development, 44-45, 50-51
  and environment, 54, 55-56, 63, 68-79, 70, 72
Sociopetal design, 17, 19
Spatial variety, 20, 48, 65-66, 78-79, 84
Unified Play Space, 19 illus.
Visual impairments, 10, 12-13, 14
Washington Environmental Yard, 20 illus., 55 illus., 64
Wildwood Preschool, 49 illus.